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Using Data to Guide Curriculum Development: How Curriculum Developers Use Formative and Summative Assessment Data to Inform the Written Curriculum

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Using Data to Guide Curriculum Development: How Curriculum Developers Use Formative and Summative Assessment Data to Inform the Written Curriculum

by

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Treatise

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Dedication

To my husband and best friend, William-
There is no way I would be where I am today were it not for you.
You have been my rock and my refuge,
and I look forward to spending the rest of my life with you.

To my sweet girl, Caitlyn, and my precious baby, Caleb-
Thank you for sharing Mommy with this work.
Let it serve to remind you
that you can do anything you put your mind to.

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Using Data to Guide Curriculum Development: How Curriculum Developers Use Formative and Summative Assessment Data to Inform the Written Curriculum

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This study examined how student achievement data are used to guide the development of curriculum documents in public school districts and within a commercial curriculum supplier. Two research questions guided this study: (a) How do public school districts in Central Texas use formative and summative assessment data to inform the written curriculum, and (b) how do commercially produced curricular programs use formative and summative assessment data to inform the written curriculum?

A qualitative multiple-case study included curriculum developers from public school districts and a commercial entity. Data included semistructured interviews with curriculum developers from each organization as well as an extensive document review from each entity. The data were coded according to first-level coding and pattern coding. These themes were then analyzed through pattern matching and cross-case analysis.

The research revealed that formative and summative assessment data were used to guide the development of the written curriculum in terms of guiding vertical alignment,

determining the scope and sequence of the curricular content, adding specificity to the curriculum documents, identifying and correcting curriculum gaps, guiding development of formative assessment, and adapting to state and national change. In addition, the organizations utilized available resources in curriculum development and created a culture of data-rich dialogue. Findings also revealed that the ability of curriculum developers to use assessment data to inform the written curriculum is impacted greatly by organizational size and capacity. Sustainability of organizations to maintain a comprehensive, aligned curriculum is influenced by the rate of change coming from the state and national level.

In conclusion, districts need to develop or obtain a guaranteed and viable curriculum that is strategically planned, comprehensive and aligned, as well as shaped by assessment data. The research reinforced that how data are created, presented, and used is important. Data sources need to be valid and reliable and shared in a risk-free culture that allows educators to move beyond elementary data uses to use data to inform the written curriculum as an integral part of school improvement.

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Chapter 1: Introduction of Study

In 1990, the Commission on the Skills of the American Workforce submitted a report regarding the globalization of the world's economy (National Center on Education and the Economy, 1990). The report noted that America was losing many low-skill, low-wage jobs to countries that paid much less. The recommendation was to ramp up education to focus on high skills (National Center on Education and the Economy, 1990). If the world stood still while we did that, perhaps all would have been well, but it did not. In *The World is Flat*, Friedman (2005) outlined how the world continues to be leveled (flattened) by technology and other forces so that even high-level jobs are in competition as well. The new report from the Commission on the Skills of the American Workforce (National Center on Education and the Economy, 2007) echoed this sentiment and recommended bold moves in terms of teacher recruitment, national standards and assessment, and support for adult continuing education.

There is no question that an effective education is critically important not only to the global economy, but also to the individual welfare of each student. The question lies in how best to achieve a successful education for every student (Hirsch, 1996). Some have focused on implementing new programs, whereas others have focused on acquiring new resources (Simmons, 2005).

One major shift has been from working harder to working smarter. As Simmons (2005) noted, "Education reforms over the past two decades have tended to emphasize *will* rather than *skill*" (p. 5). A newer focus of education improvement

research has analyzed how comprehensive improvement can be achieved through ensuring viable core systems and effective analysis of those systems (Marzano, 2003; Senge, 1990; Supovitz & Klein, 2003).

One of those core systems and a critical indicator for student success is a guaranteed and viable curriculum (Crommey, 2000; Datnow, Park, & Wohlsetter, 2007; Eisner, 1982; English & Steffy, 2001; Hirsch, 1996; Marzano, 2003, Tyler, 1949). Curricula exist in various forms, from the written curriculum to the taught curriculum to the test curriculum. Within and between each, there must be alignment (English, 2000; English & Steffy, 2001), specificity (Chappuis & Chappuis, 2007; Tyler, 1949), and adequate scaffolding to ensure there are no gaps (Glatthorn, 1999; Hirsch, 1996; Jacobs, 1997; Tyler, 1949). Although there is much focus on student performance, there first must be a comprehensive curriculum in place from which these performance scores are derived (Crommey, 2000; Datnow et al., 2007; English, 2000; English & Steffy, 2001; Marzano, 2003).

One initiative of increasing popularity is the use of data to increase student performance (Bernhardt, 2004; Bernhardt, 2005; Boudett, City, & Murname, 2005; Datnow et al., 2007; Supovitz & Klein, 2003; Wayman, Cho, & Johnston, 2007). Data have been used for a myriad of purposes. Some have focused on data use towards improving their accountability standings (Coburn & Talbert, 2006; Earl & Fullan, 2003), whereas others have focused on data use to guide program and policy decisions (Coburn & Talbert, 2006; Earl & Fullan, 2003; Honig & Coburn, 2005). One major use of data has been to identify students in need of assistance and to

develop intervention plans for them (Bernhardt, 2004; Coburn & Talbert, 2006; Datnow et al., 2007; Supovitz & Klein, 2003; Wayman et al., 2007).

Although the use of data in these functions is critical, there is little evidence in the current body of literature to indicate that data are being used to assess the potentially underlying disconnect in the actual written, taught, or tested curriculum that is being implemented (e.g., Datnow et al., 2007; Wayman et al., 2007).

Purpose of the Study

In order to compete in this global economy, all children must receive an effective education. English and Steffy (2001) contended, "Creating a competitive level playing field for all children means assuring them that they will not be tested on knowledge or skills they have not been taught" (p. 55). This means developing a viable curriculum (written, tested, and taught) that is comprehensive and aligned as well as monitoring its implementation and impact.

Assessing the curriculum requires using data to positively impact teaching and learning. Yet, schools and districts need to go beyond their current data use and begin to use data to fully analyze their curriculum (Crommey, 2000; Datnow et al., 2007). A review of the literature has revealed four phases within data use that must be navigated effectively to act as an effective agent in order to use data to inform the written curriculum: (a) data creation, (b) data retrieval, (c) data interpretation and analysis, and (d) data response.

Educators first need to be able to create the data, which requires assessments that are valid, reliable, and seamlessly aligned to the written, taught, and tested

curriculum. Once the data are created, the data need to be retrieved, which requires a district-wide data system that hosts student information, assists in the creation of assessment, and provides meaningful data reports from the assessments. The data then need to be interpreted and analyzed, which requires capacity within educators to recognize, interpret, and apply trends in the data to the written curriculum. Finally, the data need response, which culminates in changes in the written, taught, and tested curriculum. The purpose of this study was to determine how curriculum developers navigate through these phases and utilize summative and formative assessment data to inform the written curriculum.

Research Questions

In order to explain how data are used to inform the curriculum, the following two research questions were addressed:

1. How do public school districts in Central Texas use formative and summative assessment data to inform the written curriculum?

2. How do commercially produced curricular programs use formative and summative assessment data to inform the written curriculum?

Introduction to the Methodology

A qualitative research methodology was utilized in order to better understand and explain how data are used to inform the written curriculum. The multiple-case research methodology allowed for deeper insight into the issue as well as the opportunity to study the problem in its natural setting (Creswell, 2007; Yin, 2003). Purposeful sampling based on maximum variation, as described by Creswell, was

used to select three distinct public school districts and one commercially developed curriculum product (CDCP). Data were derived from multiple sources, including interviews from the various curriculum providers and document reviews. Data were coded through first-level coding and pattern coding. Two specific analytic techniques were used: pattern matching, based on the theoretical framework outlined in the literature review, and cross-case pattern analysis (Miles & Huberman, 1994; Patton, 1990; Yin, 2005). There was heavy focus on data triangulation in order to find converging lines of evidence (Yin, 2005). Standards for reliability and validity were addressed (Mertens, 2005; Yin, 2003). Further detail regarding the methodological procedures has been outlined in chapter 3.

Significance of the Study

Despite an abundance of evidence supporting how data are used to identify students in need of assistance and to develop targeted interventions (Coburn & Talbert, 2006; Supovitz & Klein, 2003; Wayman et al., 2007), there is little research on how data are used to inform curriculum development (Wayman et al., 2007). With the increased pressure of state and federal accountability systems, an effective, viable, and aligned curriculum is critical to student success. This research will expand the knowledge of data use and provide insight on how data can be used to weaknesses in the written curriculum instead of being used solely in a reactive mode to identify gaps in student learning.

Delimitations

This study focused on three public school districts in Central Texas and one commercial curriculum provider. The intent of this study was to provide insight on how some curriculum developers utilize data to inform the written curriculum. Though an attempt was made to select districts that are representative of public school districts across the state, due to the small focus of this multiple-case research design, generalization is limited.

Since this study focused on curriculum development, the persons selected for interviews were predominantly district-level personnel, including assistant superintendents as well as curriculum directors, coordinators, and specialists. The respondents represent primarily curriculum and instructional staff and are not indicative of the entire central office team or district personnel.

Limitations

Qualitative methodology, including case study research, has several limitations. Even though a multiple-case research design was used, the small sampling limits the results in terms of generalizing to other districts across the state. In addition, as Miles and Huberman (1994) pointed out, the nature of qualitative research "masks a good deal of complexity, requiring plenty of care and self-awareness on the part of the researcher" (p. 10). As this study was interpretive by nature, the researcher had to be extra cautious not to allow biases or other preconceived notions to interfere with the analysis.

Assumptions

One assumption of this study is that formative and summative assessment data can be used to inform the written curriculum. Although the use of assessment data to identify students in need of assistance and develop targeted interventions has been vast, there has been little research on how formative and summative assessment data can be used to aid in curriculum development. One assumption related to this is that valid, reliable assessments that are appropriate evaluations of student learning can be developed and implemented to obtain the formative and summative assessment data needed to inform the written curriculum.

Another assumption is that by impacting the written curriculum, student achievement will increase. Student achievement is impacted by not only by the curriculum in place but also by the instructional delivery within the classroom. Eisner (1982) noted, "What pupils learn is not only a function of the formal and explicit content that is selected; it is also a function of the manner in which it was taught" (p. 12). More explicitly illustrated, English (2000) pointed out, "Curriculum design and delivery face one fundamental problem in schools. When the door is shut and nobody else is around, the classroom teacher can select and teach just about any curriculum he or she decides is appropriate" (p. 1). Even if curriculum developers utilize data to inform their written curriculum, those revisions may not impact the instructional delivery in the classroom and thus may not impact student achievement. The circular nature of comparing student learning of specific curricular content through data analysis of assessments may address this challenge.

Definition of Terms

The following are operational definitions to the key terms used within this study:

Alignment: The degree of continuity between the content standards, performance standards, assessments, and instructional delivery in the classroom.

Central Texas: The region of Texas that includes the 60 public school districts within the boundaries of the Region XIII Educational Service Center.

Bigtown ISD: A pseudonym for the large school district interviewed in this research study.

Commercially Developed Curriculum Product (CDCP): A pseudonym for the commercial entity interviewed in this research study.

Curriculum: The content, purpose, and order of material to be learned, represented in several forms: written, taught, and tested curriculum; or the intended, implemented, or attained curriculum.

Curriculum-based assessment: An assessment that covers a specific set of content standards found within a portion of the written curriculum.

Curriculum bundle: The organization and grouping of the student expectations within the state curriculum that curriculum developers utilize in order to develop units of instruction.

Curriculum developers: The personnel who develop and make changes to the written curriculum. This designation may include assistant superintendents or curriculum directors, coordinators, or content-area specialists.

Curriculum gap: Any gap or disparity between the written, taught, and tested curriculum or the intended, implemented, or attained curriculum.

Data: Any source of evidence that provides information about teaching and learning.

Formative assessment: An ongoing process of checking for student understanding through informal probes or any evaluation that is used to guide curriculum and instruction.

Item analysis: A data report that outlines the number and percentage of students that chose each item on an assessment.

Midsize ISD: A pseudonym for the mid-size school district interviewed in this research study.

Objective analysis: A data report that highlights the number and percentage of students who mastered various Texas Assessment of Knowledge and Skills (TAKS) objectives.

Scope and sequence: Another name for a curriculum bundle in which the state curriculum standards are organized and grouped for implementation, outlining the scope (depth) and sequence (order) of each student expectation.

Student expectation: What the student is expected to know and be able to do for each state curricular standard.

Student expectation analysis: A data report that analyzes performance for every student expectation tested in an assessment.

Smallville ISD: A pseudonym for the smallest school district interviewed in this research study.

Summative assessment: The formal evaluation of whether students have mastered a particular set of content standards.

Texas Essential Knowledge and Skills (TEKS): The state-developed curriculum standards in all content areas.

Texas Assessment of Knowledge and Skills (TAKS): The state assessment in reading (Grades 3–11), mathematics (Grades 3–11), science (Grades 5, 8 10, and 11), and social studies (Grades 8, 10, and 11).

Written curriculum: The documented plan (including standards, objectives, instructional scope and sequence lessons) that teachers, campuses, and the district use to guide instruction.

Year-at-a-glance: A curriculum document that briefly lays out the written curriculum throughout the year outlining major units and corresponding TEKS.

Chapter Summary

As teachers, schools, and districts strive to meet rising standards within a complex accountability system, schools are increasing their use of data in hopes of enhancing student performance. Data use has become a basic tenet of teaching and learning, yet the use of this powerful tool rarely goes beyond identifying students in need of assistance or developing appropriate interventions for them. This study looks beyond these common uses of data and focuses on how data can be used to address

the actual curriculum being utilized and identify the weaknesses and gaps that may impact successful implementation in the classroom.

The criteria for selecting the public school districts and commercial provider have been summarized, and the methodological approach of a multiple-case research design has been outlined. The understandings gained can enable curriculum developers in other organizations to use data to inform the curriculum as a proactive step to increase student performance.

Chapter 2: Literature Review

Introduction: Using Data to Impact Curriculum Development

In order to understand how formative and summative assessment data can be used to inform the written curriculum, much must be uncovered from the literature regarding both curriculum development and data use. This chapter first highlights the need for a comprehensive curriculum, including how curriculum is defined, developed, and aligned, and how gaps or weaknesses occur. Next the focus shifts to data use, with an overview on how data have been used historically in education and particularly on how assessment data have been utilized. Finally, the literature reviewed uncovers several phases of data use that are necessary to use data to inform the written curriculum.

The Importance of a Viable Curriculum

> Curriculum problems today are closer to the heartbeat of American society than they have ever been. They are central to our economic welfare, to the vitality of our democratic political institutions, to the vexing problem of the place of religion in public life, and to the character of our intellectual and cultural life. (Walker, 2003, p. xiii)

Marzano (2003) in *What Works in Schools* identified "11 school, teacher, and student factors that are primary determinants of student achievement" (p. 58). The greatest school-level factor Marzano noted was a guaranteed and viable curriculum. Van den Akker (2003) discussed a common distinction between three types of curricula: (a) the intended curriculum (set forth by state and national standards), (b) the implemented curriculum (taught in the classroom), and (c) the attained curriculum

(actually learned by the student). Marzano argued, "The existence of state-level standards documents and district-level or school-level curriculum guides does not necessarily imply that the implemented curriculum and the intended curriculum are identical" (p. 23). Many assume that a viable, coherent curriculum is implemented in all schools, when there truly is not (Hirsch, 1996; Marzano, 2003).

A viable curriculum that is aligned, comprehensive, and effectively delivered can lead to increased student success (Crommey, 2000; Eisner, 1982; English & Steffy, 2001; Hirsch, 1996; Marzano, 2003). As English and Steffy pointed out,

> Deep alignment is a comprehensive approach to teaching and learning that goes beyond any single measure of the curriculum taught or learned. It is broadly anticipatory of any form of assessment. It is based on what we call the doctrine of no surprises, that is, children will not be taken by surprise with any form of assessment because assessment is an integral part of the instructional program, not an add-on. (p. vi)

This section analyzes how curriculum has been defined by the literature and how curriculum traditionally has been developed at the institutional level. Then the section addresses two issues within the written curriculum: vertical alignment and the related curriculum gaps.

Curriculum Defined

Curriculum has been defined in a multitude of ways (Caswell & Campbell, 1935; Eisner, 1982; English, 2000; Glatthorn, 1999; Walker, 2003; Wiles, 1999). Wiles divided curriculum definitions into subject matter, a plan, an experience, and an outcome. Walker defined curriculum simply as "a particular way of ordering content and purposes for teaching and learning in schools" (p. 11). Others have defined it as the content students are expected to learn (B. O. Smith & Orlovsky,

1978), the purposes of the educational programs (Tyler, 1949), and the document or plan that defines the work of teachers (English, 2000). Glatthorn (1999) outlined eight different forms a curriculum can take: (a) the hidden curriculum, the unintended curriculum that takes place; (b) the excluded curriculum, or what has been left out, also termed *null curriculum* by Eisner (1979); (c) the recommended curriculum, advocated by the experts in the field; (d) the written curriculum, produced at the state and local levels; (e) the supported curriculum, which appears in textbooks and ancillary materials; (f) the tested curriculum, on state and local assessments; the (g) taught curriculum, delivered in the classroom; and (h) the learned curriculum, which students ultimately master.

Curriculum Development

In Texas, curricula are guided by the TEKS. The Texas State Board of Education oversees the development and refinement of these TEKS by using committees of curriculum professionals, teachers, and experts in the field. The result is a set of standards and objectives expected to be taught in all classrooms. However, the TEKS are not sequenced or chunked, and they do not contain enough specificity in and of themselves to be used as a stand-alone curriculum. This forces districts to develop or purchase a uniform curriculum that is based on the TEKS and that meets the needs of the students and teachers within the district community.

Curriculum development is not an easy process, as Van den Akker (2003) eloquently illustrated:

> To sketch curriculum development as a problematic domain is actually an understatement. From a socio-political stance, it seems often more appropriate

> to describe it as a war zone, full of conflicts and battlefields between stakeholders with different values and interests. Problems manifest themselves in the (sometimes spectacular and persistent) gaps between the intended curriculum (as expressed in policy rhetoric), the implemented curriculum (real life in school and classroom practices), and the attained curriculum (as manifested in learner experiences and outcomes). (p. 7)

Approaches to curriculum development range from the very rational and logical (Tyler, 1949) to the more complicated and nuanced (Cary, 2006; Slattery, 2006). Regardless of the approach, curriculum development clearly should begin with fully developing the standards to be taught (or "frontloading"), prior to developing the assessment (English, 2000).

Walker (2003) noted three arenas of curriculum development: (a) the classroom, (b) the campus, and (c) the school district. At the classroom level, curriculum is at the *instructional level* and is implemented moment by moment through the instructional delivery of the written curriculum. The campus and school district are the *institutional level* of the curriculum, where policies are developed, interpretations are given, and changes are made. At this level, campus and district leaders determine the curriculum they will follow, including whether to develop the curriculum locally or purchase a commercially developed product.

Several functions of curriculum development include reviewing the school curriculum, considering curriculum changes, instituting changes, helping teachers to change their classroom curricula, monitoring curriculum change efforts, and long-term planning (Walker, 2003). This study focused on several of these functions, including how curriculum developers review the curriculum in place, how they consider changes, and how they institute that change.

Curriculum Alignment

Without alignment among the written, taught, and tested curricula, student achievement will suffer (English, 2000):

> To improve pupil test performance, it is necessary to improve the match between the curriculum content and test content. This means "tightening" the relationship between what becomes the written curriculum, the taught curriculum, and its "alignment" to the tested curricula. (p. 12)

Curriculum alignment is merely the match between the standards noted within the written curriculum, the instruction delivered within the taught curriculum, and the content assessed within the tested curriculum.

English and Steffy (2001) emphasized the preparatory work that should be done prior to aligning the curriculum. This work includes an initial phase of assembling resources, reviewing achievement data, and developing work and guide specifications. The second phase of curriculum alignment is completed by curriculum writing teams who, with an overview of the task as well as a framework for the curriculum guide, begin the tedious work of alignment.

Curriculum Gaps

Hirsch (1996) noted, "Frequent repetitions and gaps are the besetting weaknesses of local curricula" (p. 29). A curriculum gap is any disparity between the content standards that are to be taught and the actual written, taught, and tested curriculum. Just as there are different definitions and forms of curriculum, there are different types of curriculum gaps. The taught–learned gap (Glatthorn, 1999) is the "difference between what the teacher teaches . . . and what the students learn" (p. 33).

Jacobs (1997) referred to the gaps between the goals of the curriculum and what is actually taught.

Tyler (1949) argued that analyzing for gaps was a critical piece of curriculum development: "The process of evaluation is essentially the process of determining to what extent the educational objectives are actually being realized by the program of curriculum and instruction" (pp. 105–106). The data derived from formative and summative assessment can and should be used to identify and remedy these gaps, ultimately impacting the written curriculum (Crommey, 2000; English, 2000).

Importance of Data Use in Education

Datnow et al. (2007) observed, "If you don't examine the data and look deeply at the root causes, you might just be solving the wrong problem or addressing the problem the wrong way. And in the end, that won't help the students" (p. 27). Aside from the overarching goal of increasing student achievement, data have been used towards many ends. Earl and Fullan (2003) noted the variance between data used for accountability and data used for improvement. Coburn and Talbert (2006) noted that data are often used to meet accountability demands, to inform program and policy decisions, to inform student placement decisions, and to inform classroom instruction. In their meta-analysis of research on central office data use, Honig and Coburn (2005) noted that data are primarily used in resource allocation and policy development, in strategic planning processes, in choosing or abandoning instructional programs, and in seeking out research-based best practices. Datnow et al. (2007) revealed that data should be used to set student achievement goals, develop and

monitor system-wide curricula, and foster mutual accountability in system–school relationships. Finally, Supovitz and Klein (2003) described major data uses that included informing instruction, developing assistance plans, planning for professional development, setting goals, motivating faculty and students, stating priorities, and communicating with parents.

Achievement data specifically long have been used by educators, the media, and communities to assess performance of students, schools, and districts. The data are also interwoven with standards and accountability policies (Ingram, Seashore Louis, & Schroeder, 2004; McGehee & Griffith, 2001; Popham, 2007). With the influx of increased standards and accountability systems, "large-scale accountability tests have become increasingly important" (Popham, p. 146).

Using assessment data in education has great advantages. Assessments and the data they provide have been noted to act as a lever of change (McGehee & Griffith, 2001). In addition, schools that have shown the greatest improvements in student achievement use common assessments and the data that are derived from them to enhance teaching and learning (Reeves, 2004). This section will overview the various forms of assessment including formative, interim, and summative as well as how these data sources are used to impact teaching and learning.

Types of Assessment

The literature revealed several types of assessment that are used in teaching and learning. The critical component to understanding how these assessments vary is how the results are used (Black, Harrison, Lee, Marshall, & William, 2004; Chappuis

& Chappuis, 2007; Perie, Marion, & Gong, 2007). The results from formative assessments are to inform teaching and learning while summative assessments are to summarize mastery of material learned.

Formative assessment. Formative assessment is a tool to check for student progress and to aid in the overall process of teaching and learning. Chappuis and Chappuis (2008) described formative assessment as an "ongoing, dynamic process that involves far more than frequent testing and measurement of student learning is just one of its components" (p. 15). Formative assessment provides educators with feedback during the instructional cycle, while changes still can be made in the teaching and learning (Chappuis & Chappuis, 2008; Perie et al., 2007). Popham (2006) noted that formative assessments "need to have the results in sufficient time to adjust—that is, form—ongoing instruction and learning" (p. 86).

Formative assessment can happen through informal measures such as probing or progress monitoring or through more formal measures like quizzes or standards-based assessments. Formative assessment data can be used to measure student progress, adjust instructional strategies, and give students ownership of their learning (Chappuis & Chappuis, 2007). Formative assessment also can highlight curriculum gaps or gaps between the written and taught curricula (English, 2000).

Interim assessment. Some scholars have developed an intermediate category of assessments, known as interim assessments (Perie et al., 2007; Popham, 2006). These are either curriculum-based or benchmark assessments. Curriculum-based assessments cover the specific curriculum that has just been taught. Benchmark

assessments are administered at any point throughout the year to measure progress. Some argue that interim assessments are both formative and summative in nature, depending on how the results are used (Black et al., 2004).

Summative assessment. Summative assessments are tools for evaluating student mastery. Perie et al. (2007) noted, "Summative assessments are given one time at the end of the semester of school year to evaluate students' performance against a defined set of content standards" (p. 3). Summative assessments often take the form of end-of-year assessments, midterm or final exams, or statewide examinations. The results from summative assessments are used to determine grades or placement, to measure program effectiveness, or to rate the progress of schools and districts (Chappuis & Chappuis, 2007).

Types of Data Use

Much research has been conducted regarding the use of data in education, particularly in how various educators (teachers, instructional specialists, principals, and central administration) use data to enhance teaching and learning (e.g., Chappuis & Chappuis, 2007; Perie et al., 2007; Wayman et al., 2007; Wayman & Stringfield, 2006). In a recent study of the Natrona County School District (NCSD), Wayman et al. (2007) analyzed data use district-wide and found that, despite pockets of educators excelling in their use of data to increase student performance, more areas were in need of improvement for NCSD to be considered a data-informed district. Within that study, Wayman et al. (2007) surveyed various educator groups to identify the ways they used data. Specifically, they surveyed the educator groups on 12 uses of data

(see Table 1). Both teachers and administrators scored highest in identifying individual students who needed remedial assistance and developing recommendations for tutoring and educational services for students.

One area in which teachers and administrators scored particularly low was in identifying and correcting gaps in the curriculum. In fact, out of the 12 indicators, identifying and correcting curriculum gaps placed 8th for teachers and dead last for principals. More surprisingly, central office administrators also scored low in this area, with curriculum gaps ranking 7th out of 12 with a mean response of just 2.31, far lower than any mean response from any indicator in the teacher or administrator groups.

Table 1

Respondent Mean Rankings of Data Use, by Role

Data use	Teachers	Administrative teams	Central office
1. Identifying individual students who need remedial assistance.	3.17	3.39	2.46
2. Developing recommendations for tutoring & educational services for students.	3.06	3.42	2.38
3. Tailoring instruction to individual students' needs.	3.03	2.79	2.38
4. Setting school improvement goals.	2.99	3.50	2.38
5. Setting learning goals for individual students.	2.97	3.16	2.31
6. Evaluating building achievement trends and performance.	2.83	3.26	2.46
7. Assigning or reassigning students to classes or groups.	2.83	2.92	2.15
8. Identifying and correcting gaps in the curriculum for all students.	2.79	2.66	2.31
9. Encouraging parent involvement in student learning.	2.68	2.84	2.00
10. Identifying where teachers need to strengthen content knowledge, teaching skills.	2.59	2.74	2.15
11. Determining topics for professional development.	2.56	3.03	2.23
12. Evaluating district achievement trends and performance.	2.51	2.87	2.62

Note. Mean scores on a 4-point scale, with 4.0 representing highest frequency use. Adapted with permission from *The Data-Informed District: A District-Wide Evaluation of Data Use in the Natrona County School District,* p. 75, by J. C. Wayman, V. Cho, & M. T. Johnston, 2007, Austin: The University of Texas.

The field of research also has focused on these top uses of data (identifying students in need of assistance as well as developing targeted interventions for them) with less emphasis on how to use data to inform the written curriculum. Boudett et al.'s (2005) comprehensive work on using assessment results to improve teaching and learning emphasized individual-student data analysis as well as analyzing instruction, rather than using the assessment data to examine the actual curriculum. Coburn and Talbert (2006) discussed using data to inform classroom instruction but focused on meeting learners' needs through intervention plans. Suppovitz and Klein (2003) went into great detail on how data can be used to impact instruction, but again most of the work was focused on enhancing instructional strategies on a daily basis versus a more comprehensive approach to informing the written curriculum.

Using Data to Inform the Written Curriculum

Using data to inform curriculum development has been discussed in theory in the field of formative assessment. Perie et al. (2007) argued, "The primary goal of an interim assessment designed to serve instructional purposes is to adapt instruction and curriculum to better meet student needs" (p. 15). Chappuis and Chappuis (2007) noted that the data from assessments can be used to "select and re-teach portions of the curriculum that students haven't yet mastered" (p. 16). Perie et al. analyzed how data were used to "diagnose gaps between student knowledge and intended curriculum" (p. 9).

As basic as using student learning information to impact the development of written curriculum may seem, the process is much more complex. Coburn, Honig,

and Stein (in press) noted, "The actual process by which district personnel draw on research is a complex and at times messy one that is mediated by individual and collective interpretation and shaped in fundamental ways by organizational and political conditions" (p. 1). Although districts vary immensely in size, most districts have multiple people working on the written curriculum and writing the assessments for that curriculum, along with multiple campuses of teachers implementing the curriculum. This potentially built-in disconnect is difficult to overcome, especially when coupled with the organizational and political conditions that most districts face: impact of state-led curriculum revisions, composition of district curriculum-writing teams, and teacher or campus commitment to curriculum implementation.

If we know that data should be used to inform the written curriculum, why do many schools (including those in NCSD) struggle with effectively using data for this purpose? The literature has suggested several issues related to four phases of data generation and use that must be navigated effectively in order to use data to inform the written curriculum:

1. *Data creation* includes the process of developing and maintaining a comprehensive, aligned curriculum and then creating or obtaining assessments that are not only valid and reliable, but also seamlessly aligned to the learning standards within that written and taught curriculum (Chappuis & Chappuis, 2007; English, 2000; McGehee & Griffith, 2001; Perie et al., 2007; Popham, 2007; Tyler, 1949).

2. *Data retrieval* involves finding and implementing a district-wide data system that collects and connects student information, assists in the creation of

assessments, and provides user-friendly reports that highlight areas of strength and weakness (Bernhardt, 2005; Datnow et al., 2007; Honig & Coburn, 2005; Perie et al., 2007; Supovitz & Klein, 2007; Wayman, 2005; Wayman et al., 2007; Wayman, Stringfield, & Yakimowski, 2004).

3. *Data interpretation and analysis* involves the overall process for organizing, analyzing, and interpreting data as well as the deep content knowledge needed to recognize, interpret, and remedy weaknesses within the written curriculum (Black et al., 2004; Coburn et al., in press; Earl & Fullan, 2003; Ingram et al., 2004).

4. *Data response* is the actual response to the data interpretation that results in active changes in the written, taught, and tested curriculum (Chappuis & Chappuis, 2007; Coburn et al., in press; Copland, 2003; Datnow et al., 2007; Doyle, 2002; Perie et al., 2007).

The following sections focus on how each of these phases impacts the work of using assessment data to inform the written curriculum. Each section begins with an in-depth look at each phase, highlighting what the literature notes regarding the importance, complexity, and possibility of each and then examining the themes that have emerged.

Data Creation

One factor that makes using data to impact curriculum development difficult is the amount of work that has to be done prior to retrieving data for effective interpretation and analysis. To have data that can be used to inform the written curriculum, a comprehensive curriculum first must be in place. In addition, there must

be aligned assessments that are tied to that curriculum and thus can produce meaningful data. Datnow et al. (2007) noted, "Data-driven decision making was greatly facilitated when clear, grade-by-grade curricula were adopted system-wide, when high-quality materials were aligned to the curriculum, and when pacing guides clearly described the breadth and depth of content to be taught" (p. 23). For many curriculum developers, the challenge of developing and maintaining a comprehensive, high-quality, system-wide curriculum as described above is great. But it is the critical first step in data creation.

Once a comprehensive curriculum is in place, valid, reliable assessments must be shaped to measure the expectations within the curriculum. Chappuis and Chappuis (2007) observed that when administering a formative or summative assessment, teachers need to know the "specific learning target of each task their test measures" (p. 16). The data creation phase begins with identifying the learning targets that have been written into the curriculum, have been taught in the classroom, and will be measured on the assessments. Chappuis and Chappuis (2007) stated, "If the assessment items are explicitly matched to the intended learning targets, teachers can guide students in examining their . . . answers" (p. 16). Perie et al. (2007) also noted that an effective interim assessment system must include "high quality test items that are directly linked to the content standards and specific teaching units" (p. 20).

In order to generate data that will be purposeful in the interpretation stage, a comprehensive, aligned curriculum first must be in place (English, 2000; Marzano, 2003). In addition, the assessments developed to evaluate student mastery of that

curriculum must contain high-quality items that are each aligned to a particular student expectation or content standard.

A critical decision for districts is whether to design teacher-created assessments or obtain commercially developed assessments (Chappuis & Chappuis, 2007; Datnow et al., 2007; Perie et al., 2007). The literature varies in that answer. Regarding the importance of timely results and the individual needs of students, Chappuis and Chappuis (2007) argued, "When we try to teacher-proof the assessment process by providing a steady diet of ready-made external tests, we lose these advantages" (p. 18). Perie et al. added that classroom-based formative assessment has the greatest impact and that "there is little research that these commercially available assessments positively affect student achievement" (p. 1). There is also a danger in working with premade assessments, because there is little flexibility in curriculum alignment (i.e., in choosing which standards to test at which time). However, one of the areas in which teachers often struggle in creating interim assessments is validity and reliability (English, 2000; Perie et al., 2007). Because commercially developed assessments are usually created by professional assessment developers, there is a greater chance for validity and reliability.

These diverging needs have led vendors towards software solutions that host premade assessment items that teachers may pull into their own assessments that become personalized to their curriculum sequence (Wayman et al., 2004). This synergistic partnership between the vendor and district allows for district leadership to remain confident in the validity and reliability of the items yet maintain the ability

to personalize each assessment to the sequence of content standards taught at specific times.

Creating the data requires both knowledge and skill, suggesting a need for professional development (Datnow et al., 2007; Honig & Coburn, 2005). Teachers need to understand the basic tenets of curriculum development: truly understanding the content standards, developing vertical alignment from those standards, enhancing specificity within the curriculum documents, and developing lessons that are aligned to those standards. Teachers also need to build a basic assessment literacy that includes understanding the different types and purposes of assessments (formative, interim, summative, etc.) as well as developing the skills to build a valid and reliable assessment aligned with the written curriculum. If technology is also utilized to help create the assessments, professional development is needed to ensure that teachers have the capacity to operate the data system efficiently and effectively.

Although the first step that many take in creating data is developing a comprehensive curriculum that has aligned assessments and providing the support to do so, some would argue that the entire process of data creation must begin with calibration. *Calibration*, defined by Wayman, Midgley, and Stringfield (2006) and expanded by Wayman, Conoly, Gasko, and Stringfield (in press), is the process of collectively devising a set of standards or norms. Although these researchers discussed calibration in terms of the entire data-informed district, this same process could be precisely focused on data creation in both philosophical and practical dialogue:

1. What is learning?

2. How will we know when it occurs?

3. How do the implications of those answers shape the assessments we use to create, retrieve, interpret, and respond to the data?

4. How often, and in what format, will we assess?

5. How will we ensure that our assessments are tied to the written, taught, and tested curriculum?

6. Will we limit the number of objectives tested on each interim assessment so that the data can be reliable?

Data creation must begin with a conversation about how learning is defined as well as how data will be created, retrieved, interpreted, and responded to in order to support that process. Calibration provides a forum for this dialogue and allows a wide range of stakeholders to determine how the business of teaching and learning ought to take place as well as to develop shared values and a common purpose of the assessment system.

This first phase of creating the data begins with a dialogue of how to define learning and how to use data to support the process of teaching and learning. It is the process of ensuring alignment of the written, taught, and tested curriculum through the development of a viable curriculum and assessments that will produce meaningful data points about that curriculum. Creating good data is dependent on the capacity of educators and requires rigorous professional development in understanding the basic components of assessment literacy, such as alignment, bias, validity, and reliability.

Data creation is the first step yet is extremely critical in order to attain the information needed to use data to inform the written curriculum.

Data Retrieval

The second phase required after data creation is data retrieval in a user-friendly format that allows for meaningful interpretation and analysis (Bernhardt, 2005; Datnow et al., 2007; Honig & Coburn, 2005; Wayman et al., 2007). Bernhardt (2005) noted, "Without data tools, our vision of data-smart schools is merely a dream" (p. 1). With the onset of technology-driven data systems, the accessibility of data should be great. Wayman et al. (in press) noted that these technologies "can offer unprecedented access and assemblage of learning data at the individual student level" (p. 2). However, with unprecedented access and assemblage of data comes new and unpredictable complexity (Coburn et al., in press):

> Central office administrators rarely receive information in discrete manageable packages. Rather, they face complex single, and sometimes, multiple pieces of evidence that may be interpreted in a variety of ways, none of which point unambiguously to how to strengthen objective performance outcomes.

These inherent complexities necessitate structured, sophisticated and streamlined data retrieval.

One aspect that could add structure to the complexity that Coburn et al. (in press) described is the ability to retrieve the data by varying levels of specificity. Perie et al. (2007) noted,

> Many systems aggregate the items into clusters or subscores. That is, the results may be broken out by content strand, so a student may have an overall score for a math test and also have subscores in numbers and operations, geometry, and measurement. (p. 20)

It is critical within this stage that the data retrieval process be structured in a way such that data can be retrieved at the student level, the item level, the specific student expectation level, and the overall objective level. Many data systems are effective at this level of data analysis (Wayman et al., 2004).

Regarding the need for a more sophisticated system, it is important not only to retrieve those data points, but also to have a system that will do more than just crunch the numbers. Most technology systems, however, cannot yet provide more than numbers. As Perie et al. (2007) argued, most commercial systems currently do not "provide rich detail about the curriculum assessed . . . provide detailed information on the student's depth of knowledge on a particular topic . . . [or] answer what the possible strategies are for improving performance in the content area" (p. 34). Perie et al. discussed the importance of reporting results, noting, "A good report will indicate not only which questions a student answered incorrectly, but also what the student's incorrect response or set of responses implies about learning gaps or misconceptions" (p. 20). One of the companies highlighted in Wayman et al.'s (2004) overview of student data software systems is broaching this high level of sophistication. Several vendors that focus on curriculum and assessment have developed programs that allow teachers to see not only what questions students have answered incorrectly, but also an easy-to-read analysis of why the student missed the question (concept error, guess, context issue, etc.). This level of sophistication may have huge implications for using data in the development of written curriculum.

One of the greatest challenges in data retrieval is negotiating the myriad of data sources. Wayman et al. (in press) noted, "Data systems are not typically integrated to share information, so users must access different systems for different forms of data" (p. 30). Wayman (2005) categorized various data sources into (a) a student information system that houses all of the general information about a student (demographics, attendance, grades, etc.), (b) an assessment system that manages various assessments, and (c) a data warehousing system that can connect the otherwise disparate pieces of information.

Similar to the debate in whether to create or obtain assessments, there is a debate in deciding whether to create or obtain a data warehousing system. Although the arguments are strong on both sides, Wayman et al. (2004) pointed out both the time and cost of building a data system from the ground up. Their argument highlights the time it takes in creating a system (often several years) as well as the cost in terms of loss of personnel focused on building the system.

The data retrieval phase could be helped greatly through continuing the calibration process. Dialogue regarding the required data sources, methods of data retrieval, reporting requirements, as well as whether the system should be bought or built is essential to ultimately receiving the necessary data to inform the written curriculum. The key for successful data retrieval is for district staff to have an understanding of the various data systems in use and the ability to seamlessly streamline their uses.

As data retrieval systems increasingly become technology based, ease of use for those systems is extremely important. Perie et al. (2007) noted several drawbacks to relying on technology, including the challenge in building technological capacity within teachers along with the reduction of interaction between the student and teacher within the assessment process. Wayman and Stringfield (2006) highlighted the potential that technology can bring, noting, "Many new users were happy that the user-friendly interfaces helped them spend less time learning the software and more time learning data techniques" (p. 560).

In the same way that the need for professional development was discussed in building assessment literacy during the data creation phase, there is a tremendous need for building capacity within teachers to operate the data retrieval systems. Wayman and Conoly (2006) described how one school district strategically rolled out professional development in order to ensure success of a district-wide data initiative. The roll-out consisted of a trainer-of-trainers model, wherein each campus and instructional office allocated one trainer to serve as the lead for that campus or department. Those lead trainers then provided district-wide training to over 500 employees across the district. One interesting aspect of the school district's model was the inclusion of specific goals. According to Wayman and Conoly, the team "identified five achievable goals for year one implementation, to be achieved by each school" (p. 6). This level of detail and follow-through can ensure effective implementation of the data initiative.

In order for data to be in a format that ultimately allows districts to use data to aid curriculum development, data retrieval systems must be structured to allow for specific levels of data, sophisticated in the way that they provide more than just numbers, and seamlessly integrated to allow for teacher efficiency and use. Professional development must be strategically planned, timely, widespread amongst all users, and inherent with expectations and measurable goals.

Interpretation and Analysis

If creating seamlessly aligned curricula and assessments and retrieving purposeful data sets from those data were not challenging enough, the task of interpreting and analyzing data in light of using data to inform the written curriculum can be even more complicated and challenging (Coburn et al., in press; Earl & Fullan, 2003; Honig & Coburn, 2005). As Coburn et al. noted, "Even if the appropriate evidence is available, evidence does not speak for itself. Rather, it must be accessed, noticed, and interpreted" (p. 3). In some circumstances, interpretation comes easily. Wayman et al. (2007) noted that NCSD educators were extremely adept at "identifying individual students who need remedial assistance" (p. 75). One reason why this data use ranked at the top for NCSD teachers is that the level of interpretation needed to identify students in need of assistance is minimal. The interpretation and analysis required to use data to identify and remedy weaknesses in the curriculum, however, are highly complex.

One reason for the complexity is the deep knowledge required to make sound interpretations. Black et al. (2004) noted that detailed knowledge is necessary to choose questions and interpret student answers:

> Pedagogical content knowledge is essential in interpreting responses. That is, what students say will contain clues to aspects of their thinking that may require attention, but picking up on these clues requires a thorough knowledge of common difficulties in learning the subject. (p. 17)

Black et al.'s explanation has huge implications for interpretation and analysis, as central offices are often not staffed deeply enough with content specialists at all levels, and teachers are not trained in the analysis required to gauge the root cause of the student responses.

Another aspect of the complexity comes from the multitude of variables within the interpretation. Each data source (objective analysis, student expectation analysis, or item analysis) requires layers of interpretation to analyze whether the data points are truly from weaknesses in the curriculum or are impacted by other variables. One of those variables is the level of alignment among the written, taught, and assessed curricula. Even if the data highlight an area of weakness, it is sometimes difficult to know whether the issue is in the written curriculum (curriculum documents, lesson plans, etc.), in the taught curriculum (classroom instruction), in the assessed curriculum, or an actual measure of deficient student learning.

Other variables include the number of items tested within a content strand. Lower numbers often speak more to the item than to the content strand. The sequence of items within the taught curriculum may reveal a retention issue regarding earlier content than a curriculum issue. Also, the preconceived beliefs of the interpreter may

be injected into the interpretation and prioritization of data. Coburn et al. (in press) expanded on this issue, noting, "Administrators tend to see aspects of the data or research that support their beliefs, assumptions, and experiences and do not even notice those aspects of the data that might contradict or challenge these beliefs" (p. 7).

Compounding the complexity, the element of time is often a barrier to data interpretation and analysis (Copland, 2003; Datnow et al., 2007; Ingram et al., 2004; Wayman et al., 2007). Ingram et al. noted, "Schools rarely provide the time needed to collect and analyze data" (p. 1281). In order for the deep interpretation to occur, time must be provided or, better yet, embedded into the routine. Copland (2003) noted that principals who are successful in building and sustaining capacity for school improvement create ongoing, regular time and space for the inquiry to occur. Wayman et al. (2007) quantified that time: "Structured, directed time must be offered at least once a week; more often is preferable" (p. 54). Again, if the task is to review results from an assessment and highlight the names of those who failed to meet the standard in order to provide intervention, the time needed is minimal. In the case of using data to inform the written curriculum, the task is much larger, more complex, and more time intensive.

One way to overcome these complexities and ensure sound interpretation and analysis is to engage in data triangulation. Triangulation of data is a way to give meaning to the complex pieces of data found upon inspection. Wayman et al. (2007) described several processes whereby campuses used multiple sources of data to make educational decisions about student progress, grouping students, and program

evaluation. In the same respect, triangulation is extremely critical in identifying curriculum weaknesses to ensure that the data come from the curriculum gap and are not an implication of the variables described above.

Using multiple sources of data can be extremely effective in lending a better understanding of the success of student learning (Bernhardt, 2004; Datnow et al., 2007; Supovitz & Klein, 2007). Several data sources may be useful in this triangulation process. The first includes examining the written and assessed curriculum. As soon as a low data point arises, a quick search within the written curriculum and assessments can allow an inspection of the existence and thoroughness of the curricular area. The next step may include working with teachers to hear how they address the curriculum area. A third step may be participating in classroom walk-throughs to observe how the learning expectation is exhibited within the instruction. The compilation of all of those data along with the initial data will provide the depth of triangulation needed to determine whether a curriculum weakness exists.

It is critical to build capacity for this triangulated data interpretation within teachers and curriculum leaders. Knowing that this process is nonlinear, complex, and often subject to interpretation, Wayman and Stringfield (2006) observed, "Few educators are prepared to make efficient use of this abundance of data, so these systems must be supplemented with professional support that helps educators turn student data into information that can inform classroom practice" (p. 550). Just as professional development was noted as a critical component in being able to create

and retrieve the data, it is also integral to being able to interpret and respond to the data (Coburn et al., in press; Datnow et al., 2007; Honig & Coburn, 2005; Wayman & Stringfield, 2006). The professional development could begin with basic concepts such as analyzing items and strands based on content (whether the item or strand was taught), context (the item or strand was taught but in a completely different context), complexity (the item or strand was taught but at a much lower cognitive level), or crossover (the item or strand was carried over from another subject or a previous year). The training then could focus on utilizing data triangulation and even building protocols that would guide instructional leaders through the interpretive process.

The process of interpreting data for curriculum analysis is laden with complexity and is often neglected for more concise data analysis (e.g., student performance in a pass–fail format). Yet, this function of data use is critical for student success. This section described the reasons for the complexity, including the deep content knowledge needed, the multitude of variables involved, and the multiple sources of data needed to initiate a data triangulation process that will ensure sound interpretation. In order to accomplish all of this, time and training is needed. Directed, structured, and embedded time is critical to accomplish this work, as is rigorous professional development to build capacity within educators to use data to inform the written curriculum.

Data Response

Each of the initial three stages focused on using data to identify areas of weakness in the written curriculum. The last stage, data response, is focused on

addressing those issues and adjusting the written curriculum. As Doyle (2002) noted, "simply possessing data and evidence is no guarantee of success" (p. 1). Such data must be put to use and lead towards action.

Chappuis and Chappuis (2007) posed this question to students, but the same could be asked of teachers: "What do these results mean for the next steps in my learning, and how should I prepare for that improvement?" (p. 17). Teachers should look at the data not just to assess and analyze past performance, but also to ask what the data mean for their practice and their own teaching and learning. As one principal noted in Copland's (2003) study of continuous school improvement through inquiry, "What I see that doesn't happen here is the deep level of analysis that results in change" (p. 385). The final step is response and change.

Making use of the data requires probing deeply, considering the implications, and engaging in a course of action. Perie et al. (2007) observed,

> A true formative assessment system does not stop with the development and administration of a test, but includes analyses that probe more deeply into what an incorrect answer implies about student learning and what should be done next or in the near future to further that learning. (p. 5)

Coburn et al. (in press) described the process of responding to the data as follows: "Once a given piece of evidence has been 'found' decision-makers engage in a process through which they decide whether and how to use the information" (p. 7). Coburn et al. went on to classify four types of response (or roles) to which data lead: (a) an instrumental role, (b) a conceptual role, (c) a symbolic role, and (d) a sanctioning role. With regards to using data to inform the written curriculum, an instrumental response would be to overhaul the curriculum in the identified areas of

weakness. According to Coburn et al., a conceptual response might be to utilize the data to change the way teachers view the curricular area, whereas a symbolic response might be to use the data to justify "pre-existing preferences or action" (p. 15). A sanctioning response to the data would be to hold teacher's implementation of the written curriculum accountable through sanctions.

One of the variables that shape the response to the data is the composition of the district. Curriculum development is often a district-wide process, making the work not only critical, but also difficult. Honig and Coburn (2005) noted, "Ultimately, though, implications for action are often unavoidably ambiguous, especially in complex systems like district central offices" (p. 24). Rather than just adjusting a lesson plan within a unit, making changes to the written curriculum requires gathering the key leaders and teachers to discuss the issues and then providing time, resources, and support to revise the documents. Unfortunately, many districts lack those critical resources (Honig & Coburn, 2005). Even if all of that does occur, implementation of those changes needs to be tracked to ensure that the weaknesses in the curriculum no longer remain.

Another variable that shapes the response to data is the culture in which it the data are presented. The literature has shown that time is essential for reflective data work (Copland, 2003; Datnow et al., 2007; Ingram et al., 2004; Wayman et al., 2007). In addition, creating a risk-free culture is critical to effective data use. Part of that culture includes eliminating blame (Datnow et al., 2007; Doyle, 2002; Earl & Fullan, 2003). Doyle (2002) said,

> Because data have been used historically to point the finger of blame, it is difficult to convince educators that the next round of data collection will be used as a resources, as an opportunity to trumpet successes and seize opportunities. (p. 2)

Researchers have noted that a major shift often needs to occur in order for educators to be receptive to using data to improve teaching and learning. One way to nurture that shift is to gain buy-in from all stakeholders (Datnow et al., 2007)

Wayman and Stringfield (2006) studied change in teacher practice surrounding data use and found marked changes in teachers with regards to efficiency, response, reflection, and collaboration. Although their study focused on responses from using a student data system, these same responses might apply to the work of using data to inform the written curriculum. Wayman and Stringfield described teachers as feeling more efficient and responding better to student need. These same responses could be effective in working with curriculum weaknesses. Gaps in the curriculum are a core issue of teaching and learning. Often, teachers are overwhelmed in treating the symptoms (in many cases, poor student performance), and they lose efficiency and efficacy within their practice. With a strong system to inform the curriculum, teachers could focus their time teaching the right material at the right time with confidence that the alignment would lead to better learning. Wayman and Stringfield also noted that teachers consistently using data have a stronger reflection of their practice and increased collaboration among colleagues. As noted in the interpretation phase, the best way to use data to impact the written curriculum is through collaborative reflection of the data. Both could be responses to the data.

Clearly, professional development and support are necessary within the data response phase not only to determine the changes needed in the written, taught, and tested curriculum, but also to initiate those changes and to ensure effective implementation. The professional development would reinforce the building blocks of curriculum development, including the importance of alignment within the written, taught, and tested curriculum, as well as provide oversight to the curriculum revision process.

If given these resources and support, data can be used to inform the written curriculum. Datnow et al. (2007) noted that data may lead educators to "be more thoughtful about pacing and distributing good teaching practices" (p. 23). Crommey (2000) noted that data may lead educators to find deficiencies or gaps within the curriculum.

No one phase of the data creation, data retrieval, data interpretation, and data response cycle is more important than another. Inarguably, without a cohesive, district-wide approach to responding to the data, using data to inform the written curriculum will not occur. This section has described the need to determine what role the data will play, how the district will guide that work, and the professional development and support needed to initiate change and ensure implementation.

Discussion

To be a truly data-informed school district, using data must be at the heart of teaching and learning (Wayman et al., 2007). Chappuis and Chappuis (2007) claimed, "The greatest value in formative assessment lies in teachers and students making use

of results to improve real-time teaching and learning at every turn" (p. 18). Data use should not just mean identifying students at need or completing a district improvement plan. It should include using data to impact teaching and learning in a way that benefits students. It is also using data to address every aspect of teaching and learning, including using data to inform the written curriculum.

This study stemmed from one of the basic findings from Wayman et al.'s (2007) work in NCSD: While teachers, principals and central office administrators were using data at varying levels to enhance teaching and learning, the specific use of using data to identify and correct curriculum gaps was a glaring weakness across the district. This study is also based on the core premise that the work of using data to inform the written curriculum is critical to the overall performance of students, teachers and schools as well as to the long-term success of the district. So often we use data to identify and treat the symptom (poor student achievement, lagging teacher performance) when the root of the cause is actually the lack of alignment within the written, taught and tested curriculum. The literature has indicated several stages that are instrumental in uncovering and remedying weaknesses in the curriculum including data creation, data retrieval, data interpretation and analysis, and data response. Within and between those phases, several themes emerged that guide this discussion: the need for focused alignment, strategic district leadership, streamlined technology, targeted professional development, and extensive and ongoing calibration.

Alignment (or lack thereof) is one of the most difficult complexities to overcome. The curriculum weakness could be within the confines of a classroom or a campus or across the entire district. In the same way, the curriculum issue could involve the student, the teacher, the written curriculum, the taught curriculum, or the assessed curriculum. Identifying and correcting the weaknesses in the curriculum document are not enough. Alignment of the curriculum from year to year must be ensured within the written, taught, and tested curriculum. Finally, teachers must have deep knowledge of the curriculum in not only their grade level, but also the grade levels below and above so that they are adequately teaching each content standard.

Tyler (1949) noted that evaluation of curriculum may occur only when several aspects of the curriculum and instruction occur: Objectives are identified and clearly defined, the context of objectives is described, assessment items are developed and field tested, the data are triangulated, and the data are analyzed for validity and reliability. Before district leaders look to evaluate gaps in the curriculum, it is critical that they evaluate alignment among the written, taught, and tested curriculum and then focus on developing and enhancing that alignment.

The issues and implications that surround alignment not only necessitate district support, but also mandate district leadership. Coburn and Talbert (2006) noted the critical importance of central office administrators in forging the gap between data analysis from the district level to the individual teacher level. From guiding professional development to providing leadership in sifting through the variables, to embedding the necessary time, strategic district support and leadership are critical.

Much of that leadership can be housed within the calibration process as district leaders guide discussions through each phase of the data plan. The leadership also must guide technology decisions; plan for professional development opportunities; and lead the district in building an aligned written, taught, and tested curriculum.

The role of technology within each phase of data creation, retrieval, interpretation, and response is critical. Technology is used increasingly within each phase, as teachers build assessments on computers, retrieve data from online systems, interpret by triangulating multiple data sources, and respond to the data by revising curriculum documents. Additionally, the capacity for technology to impact this area is great. As the sophistication of technology increases, alignment will become easier to notice and address.

Districts need to streamline their use of technology in first deciding how they will use technology within the data use process. District leaders then must proactively search for the best products to meet the needs of educators at all levels. Extensive field testing of the technology is critical to ensure that the product will accomplish its goals. Districts also must invest in that technology and then focus on training teachers, principals, and central office staff in how to use the system to achieve all of the intended goals.

Professional development is critical at every level but particularly with teachers. Ingram et al. (2004) noted four barriers to effectively using data: (a) Teachers have developed their own personal system for judging the effectiveness of their teaching; (b) teachers and administrators base decisions more on experience,

intuition, and anecdotal information than on hard data; (c) little agreement about which student outcomes are most important and which data are most useful; and (d) teachers sometimes "disassociate their own performance and that of students, which leads them to overlook useful data" (p. 1281). Targeted professional development plays an instrumental role in overcoming these barriers as well as supporting each phase of the process. Within the phase of data creation, it is critical to build assessment literacy so that teachers understand the various forms and purposes of assessments. Although technology can make any process more efficient, without the proper professional development, it can be the quickest end to any initiative. Teachers need to feel comfortable using the data retrieval system and should find it adding efficiency and efficacy to their practice. Data interpretation and analysis requires rigorous professional development as teachers try to make sense of the overwhelming data they review, not only to understand and sift through the multitude of variables, but also to have deep enough content knowledge to see the discrepancies and understand the gaps. Finally, as teachers respond to the data by making changes to the written, taught, and tested curriculum, district-led professional development is critical to ensuring alignment within the curriculum revisions.

Copland (2003) described the inquiry cycle used in the Bay Area School Reform Collaborative as including steps for identifying measurable goals, building concrete work plans, taking action, and reflecting on and analyzing the results. These steps could be used to shape a district-wide data response towards informing the written curriculum. The first step might be to lay out the goals within data-informed

teaching and learning that target identifying and correcting weaknesses or gaps in the curriculum. The next step might be developing a work plan that included timelines; necessary resources; roles and responsibilities; strategies for strengthening alignment; and a system to manage implementation, including communication, shared leadership, assessment, and governance. The work would follow with actual changes to the written, taught, and assessed curriculum, ensuring support at each step from the district level. Finally, the work would include reflection and analysis from the new data to identify which areas have been corrected and areas that still need to be addressed. The calibration process could lead district leaders towards identifying each of these steps and determining how best to ensure implementation.

Because this process of using data to inform the written curriculum encompasses so many areas within curriculum, instruction, and assessment, extensive and ongoing calibration is critical. Before the phases even begin, calibration is instrumental to determine how learning will be identified and assessed. In creating the data, critical calibration conversations would focus on which type of data would be collected, which types of assessments would be used, what purposes each of the assessments would play, how the assessments would be put together, and how each content strand would be targeted. In retrieving the data, calibration would be centered on the needs of the data system, including types of data sources, the types of reports generated, and the amount of support needed for effective teacher implementation. In interpreting the data, calibration would focus on which types of data would be used to triangulate the findings as well as what processes would be utilized to make sense of

the data. In responding to the data, the calibration process would determine how changes are made within the written, taught, and tested curriculum to ensure that data are used to inform the written curriculum.

Implications for Further Research

Several areas for further research have been highlighted by the review of the literature. One is a study of a district to determine the depth of alignment among the written, taught, and tested curriculum. This would encompass an in-depth, case-study approach that relied on document review of the written and tested curriculum as well as prolonged direct observation of the taught curriculum.

Another area for further research is to examine how districts use data from formative and summative assessments to inform their written, taught, or tested curriculum. This could be a case study of one district or a comparative study among several districts. This study also could examine how commercially produced curricular products utilize data to inform the curriculum.

Finally, further research is needed into the reasons why districts can or cannot use data to inform the curriculum. This examination could be compared to the four phases of data generation discussed in the literature: (a) data creation, (b) data retrieval, (c) data interpretation and analysis, and (d) data response. Therefore, the focus of this study was on how locally developed and commercially developed curriculum users utilize formative and summative assessment data to inform the written curriculum.

Chapter Summary

The implications of a comprehensive study focused on using data to inform the written curriculum within the data-informed district are huge. Rising state and national standards leave no room for the inefficiencies and inefficacies of an unaligned curriculum. Much of the current data use is focused on symptomatic issues rather than identifying and correcting the core issues. Some students are failing because of inherent gaps in the written, taught, and tested curriculum. The use of data within the data-informed district needs to inform the written curriculum to ensure students have the opportunity to succeed. This work can happen only through a district-supported initiative that involves a series of calibration dialogues centered on the creation, retrieval, and interpretation of data that ultimately result in the use of data in informing the written curriculum.

Chapter 3: Methodology

This focus of this study was to examine how data are used to inform the written curriculum, from the perspective of individual public school districts as well as from a commercial curriculum provider. The following describes the qualitative research methodology of this multiple case study. The chapter begins with the background and purpose of the study and then outlines the research design, including the research questions, methodology, rationalization for the methodology, and strengths and limitations of the methodology. Procedures regarding respondent selection and data collection are then described. Finally, the methods of analysis are explained, including the processes used to identify themes and draw conclusions.

Background for Study

The need for a more effective education that leads to increased student performance long has been documented, yet the answer to achieve that success is not clear (English, 2000; Hirsch, 1996; Marzano, 2003; Reeves, 2004). The debate has spurred an increased focus on the need for more rigorous standards (Reeves, 2004; M. Smith & O'Day, 1990); a viable, aligned curriculum (English, 2000; Marzano, 2003); increased use of formative and summative assessment (Black & William, 1998; Chappuis & Chappuis, 2008); and growing interest in using data to increase student achievement (Bernhardt, 2004, 2005; Boudett et al., 2005; Datnow et al., 2007; Wayman et al., 2007). To date, much research has investigated data use with teachers, administrators, and central office administrators, but most of that data use focused on identifying students in need of assistance and developing appropriate interventions

(Coburn & Talbert, 2006; Datnow, 2007; Wayman et al., 2007). This study was designed to determine how data are used to address what some would say is the core of the issue: the actual written, taught, and tested curriculum. For this reason, this study focused on how curriculum developers use data to inform the written curriculum.

Purpose of Study

The purpose of this case study is to understand how curriculum developers of locally or commercially developed curricular products use formative and summative assessment data to inform the written curriculum. Chapter 2 described four phases integral to data use to achieve this end:

1. Data creation is the ability to develop a viable, guaranteed curriculum that includes valid and reliable assessments that are seamlessly aligned to the written, taught, and tested curriculum.

2. Data retrieval is the ability to find and implement a district-wide data system that hosts student information, assists in the creation of assessment, and provides meaningful data reports from the assessments.

3. Data interpretation and analysis is the ability of educators to recognize, interpret, and apply trends in the data in curriculum development.

4. Data response is the ability of curriculum developers to respond to the data with changes in the written, taught, and tested curriculum.

This study analyzed curriculum developers from three public school districts as well as the developers of one commercially produced curricular product, referred

to as CDCP, to understand and explain how they use data to inform the curriculum. Analytic techniques were utilized to determine whether developers' ability effectively to use data were consistent with their ability to negotiate through the four phases of data described above.

Research Design

A practical and strategic research design is critical within any research study (Creswell, 2007; Patton, 1990; Yin, 2003). Yin (2003) offered the following explanation of research design: "A research design is a logical plan for getting from here to there, where here may be defined as the initial set of questions to be answered, and there is some set of conclusions (answers) about these questions" (p. 20). In this section, that plan is outlined, from the research questions to the methodology to the respondent selection process.

Research Questions

The first step in developing a plan of methodology is determining the bounds of the research. This can be done through formalizing research questions and hypotheses (Miles & Huberman, 1994; Patton, 1990). The two research questions pertaining to this study were the following:

1. How do public school districts in Central Texas use formative and summative assessment data to inform the written curriculum?

2. How do commercially produced curricular programs use formative and summative assessment data to inform the written curriculum?

Qualitative Methodology

This study was based on qualitative research methodology. According to Denzin and Lincoln (2005), "Qualitative research is a situated activity that locates the observer in the world" (p. 3). Qualitative research has several commonalities, according to Creswell (2007):

1. The research takes place in a natural setting.

2. The researcher is a key instrument in the data collection.

3. The focus is on the views, perspectives, and meanings of the participants.

4. The qualitative process is loosely structured to allow for emergent design.

5. The behavior observed is often framed within a theoretical lens.

6. The research takes the shape of interpretive inquiry.

7. The researcher develops a complex or holistic picture of the issue under study.

8. Multiple data sources are collected and analyzed.

9. Data are analyzed from the bottom-up, often inductively, recursively, or interactively.

Qualitative research is also interpretive and naturalistic in its approach (Denzin & Lincoln, 2005). From a theoretical perspective, this research will be conducted from a constructivist paradigm in which, according to Mertens (2005), "knowledge is socially constructed by people active in the research process, and . . . researchers should attempt to understand the complex world of lived experience from the point of view of those who live it" (pp. 12–13).

Case study. Yin (2003) described a case study as an empirical inquiry that investigates contemporary issues through multiple sources of evidence. Depending on the realm of research (type of research questions, control over events, and focus on contemporary vs. historical issues), case studies can be an effective lens for a researcher (Yin, 2003). Some have argued that the use of case studies is not in itself a methodology (Stake, 2005), yet many others have concluded that the use of case study is a viable approach to studying an issue in depth (Creswell, 2007; Yin, 2003).

One of the most important aspects within a case study is determining the unit of analysis (Creswell, 2007; Stake, 2005; Yin, 2003). In this study, the unit of analysis were the curriculum developers within the organizational entities examined: three public school districts and one commercial curriculum developer.

Multiple-case research design. This study focused on several cases in order to explain how data are used to inform the written curriculum. Stake (2005) observed that the use of multiple cases can lead to an instrumental study that can "provide insight into an issue or to redraw a generalization" (p. 445). Multiple-case research is done best when the number of cases is limited to two to four (Creswell, 2007; Yin, 2003). For that reason, this study focused on three school districts and one CDCP.

Rationalization for Selection of Methodology

Patton (1990) noted that whereas quantitative research works well when collecting data from many people, qualitative research can "typically produce a wealth of detailed information about a much smaller number of people and cases" (p. 14). The qualitative nature of this case study allowed a vast amount of specific

information to be generated with hopes "to gain a complex, detailed understanding of the issue" (Creswell, 2007, p. 40).

Strengths and Limitations of the Methodology

Strengths of using qualitative research include a focus on events in their natural setting as well as the richness and holism of the study (Miles & Huberman, 1994). Yin (2005) stated, "[The] strength of the case study method is its ability to examine, in-depth, a 'case' within its 'real-life' context" (p. 380). In addition, Patton (1990) noted that case studies are extremely effective when trying to point out comparisons: "Case studies are particularly valuable when the evaluation aims to capture individual differences or unique variations from one program setting to another, or from one program experience to another" (p. 54). This was critical as several cases were examined with the intent to explain the similarities and differences in how data are being used to inform the written curriculum.

The strengths of utilizing a multiple-case research design is that often the evidence is more compelling, which can make the overall study more robust (Yin, 2003). The limitations in this study stem from the bounds of the case study methodology, in that only three districts and one commercial product were examined within the research.

Participants

Respondent Selection Process

Purposeful sampling was utilized in order to "purposefully inform an understanding of the research problem and central phenomenon in the study"

(Creswell, 2007, p. 125). Purposeful sampling techniques were utilized to select the three school districts as well as the CDCP.

Public school district selection. In this case, respondents were selected from the Central Texas region. The public school districts were divided between those utilizing a locally developed curriculum and those utilizing a commercially produced curricular product. Leaders of each of the districts utilizing a local curriculum were asked whether they have a locally developed, district-wide curriculum. Those who did were asked to enter the pool of public school district participants. Three school districts were chosen from that pool according to maximum variation sampling, in which diverse cases are chosen to identify important common patterns and describe multiple perspectives (Miles & Huberman, 1994). In this context, the three district cases included one small district, one medium district, and one large district. There are various ways to categorize district size. The Texas Association of Midsize Schools includes districts of 1,500–5,000 students. The University Interscholastic League classifies schools and districts according to size for extracurricular purposes. For this study, three districts were chosen in the following ranges: 0–2,000 students, 2,001–5,000, and more than 5,000 students. The determining factor in those choices relied on what Patton (1990) noted: "[The] logic and power of purposeful sampling lies in selecting *information-rich* cases for study in depth" (p. 169).

Within each school district, respondents were further specified for potential interviews. The interviews targeted those closest to curriculum development. In some districts, this included curriculum specialists and curricular area coordinators. In

smaller districts, the pool included assistant superintendents or curriculum directors. A total of 7 curriculum developers within public school districts were selected for interviews.

Commercial curriculum developer selection. In this study, the commercially produced curricular product researched was CDCP. Not only is CDCP the most prevalent commercial product used in Central Texas, it is also a statewide curriculum initiative through the Texas Education Service Center Curriculum Collaborative, which Patton (1990) and Yin (2003) noted is often utilized for case studies.

Within CDCP, respondents were further refined to engage those closest to curriculum development. The interviews targeted curriculum specialists in each core area as well as the leadership behind the statewide initiative. Four interviews were conducted within the CDCP organization.

Respondent Description: Public School Districts

Smallville ISD. The smallest of the three public school districts, Smallville ISD serves just over 1,800 students on its four campuses. The Curriculum and Instruction Department consists of one director who was new to the job this year. The sole interview from Smallville was with that curriculum director.

Smallville ISD developed a local curriculum with several other area school districts several years ago, and that work has remained unchanged. The curriculum consists of a year-at-a-glance report outlining the major units and TEKS to be covered within general timelines. Smallville ISD administers two curriculum-based assessments in mathematics each year that are developed by the director, who creates

TAKS-A, TAKS-M, and Spanish versions of each. Smallville ISD currently does not have a technology system in place but rather conducts data retrieval through scantron forms that are sorted by hand to generate district reports.

Midsize ISD. Midsize ISD serves over 3,300 students on its six main campuses. The Curriculum and Instruction Department includes one assistant superintendent of curriculum and one curriculum coordinator. Both leaders were interviewed for this study.

Midsize ISD created its curriculum through a local consortium of schools several years ago but since locally developed that initial work into the district's own curriculum. The curriculum includes vertical alignment documents, documents, 3-week bundles, and 1-week bundles. Midsize ISD has a history of annually administering curriculum-based assessments in core areas but is in hiatus while developing a more valid and reliable assessment system. In the meantime, Midsize has administered two released TAKS tests in the core areas. Midsize is seeking a technology system for data retrieval while currently generating district reports by hand through data collected at the campus level from the released TAKS assessments.

Bigtown ISD. Bigtown ISD serves approximately 20,000 students and has a Curriculum and Instruction Department of 14 people, consisting of a chief academic officer, executive director, and content area coordinators. In addition, the Assessment Department assists in some of the formative-assessment data processing. The four interviewees from Bigtown ISD were the executive director and 3 curriculum coordinators in various content areas and instructional levels.

Bigtown ISD has had several iterations of district curriculum and recently went through an in-depth rewrite of all core areas. This newly developed curriculum consists of vertical alignment documents, year-at-a-glance documents, 3-week bundles, and curriculum-based assessments. Bigtown administers three curriculum-based assessments in each core content area at every grade level, kindergarten through Grade 12 (K–12). The curriculum-based assessments are given at the end of the first, second, and fourth 9-week periods. Campuses are given an additional opportunity to administer a released TAKS test during the third 9-week period. Data are scanned and scored centrally and loaded into a district-wide technology program that generates item analysis, student expectation analysis, objective analysis, student performance, and performance data by teacher, campus, and district. The data are immediately accessible online to all teachers and administrators according to the students they instruct.

Respondent Description: Commercial Developer

The commercially developed product chosen was CDCP. Originally an initiative that began in the Central Texas region, this statewide initiative provides a "comprehensive, customizable, user-friendly curriculum management system built on the most current research-based practices in the field," according to the 2008 CDCP information guide. CDCP is used in 30 of the 60 school districts in Central Texas. Across the state, 385 school districts and 1,218 campuses are using CDCP, approximately 25% of the state.

This curriculum collaborative is overseen by a statewide director who leads both a development team and implementation team. The development team focuses on the actual curriculum development and consists of curriculum specialists in each of the core areas. These specialists also work with curriculum writers and editors from across the state. The implementation team focuses on working with the public school districts as they consider adoption of CDCP as well as providing support and professional development to those districts in the implementation phases. In all, over 30 people are involved in the CDCP group in either full-time or contractual positions. The interviews with CDCP included the statewide director, the implementation team leader, and 2 curriculum coordinators in various content areas.

CDCP is a systemic K–12 model that contains curriculum in the four core areas. The system has a common language, structure, and process for curriculum delivery, yet teachers maintain the ability to explore ways to deliver instruction for their students. CDCP has alignment in the written, taught and tested curriculum. CDCP also provides teachers and instructional leaders support in each of those aspects through the following 11 components: (a) vertical alignment documents, (b) instructional focus documents that provide a scope and sequence for each unit, (c) concept-based units of study, (d) research-based lesson plans, (e) aligned continuum of authentic performance assessments, (f) year-at-a-glance planning tool, (g) TEKS verification matrix, (h) analytic and holistic scoring guides and rubrics, (i) integrated unit assessments, (j) benchmark assessments, and (k) statewide professional development activities.

The developers noted that the primary focus of CDCP is to "impact instructional practices in the classroom to improve student performance." Although the curriculum is the primary component of the system, CDCP also provides aligned professional development, assessment options and technical support. The goal of CDCP is to deliver a guaranteed, viable curriculum. Table 2 provides a comparison between the four organizational systems and their work in curriculum development and data analysis.

Table 2

Organizational Overview

Characteristic	Smallville	Midsize	Bigtown	CDCP
Organizational size				
District enrollment	1,800+	3,300+	20,000+	Serves 1 million + students
C&I Dept. staff	1	2	14 (plus Assessment Dept.)	30+ (implementation & development teams)
Curriculum				
Creation	Through area consortium 5 years ago; not revised since	Through area consortium 5 years ago; now district customized	District created, 1year ago	Commercially developed product, 4 years ago
Development	▪ Year-at-a-glance	▪ Year-at-a-glance ▪ Vertical alignment docs ▪ 3-week bundles ▪ 1-week bundles	▪ Year-at-a-glance ▪ Vertical alignment docs ▪ 3-week bundles ▪ Curriculum-based assessments (CBAs)	▪ Year-at-a-glance ▪ Vertical alignment docs ▪ TEKS verification ▪ Instructional focus docs ▪ Unit assessments ▪ Exemplar lessons
Formative assessment	▪ CBAs, math only (2 per yr) ▪ TAKS-A, TAKS-M, Spanish versions	▪ 2 released tests a year	▪ 3 CBAs a year in all content areas ▪ Optional released test	▪ Formative assessments for classroom and unit assessments.

Data retrieval (technology system)	None; scantrons	None; scores reported to district on spreadsheets	Scanned and scored centrally, then loaded through DMAC. Generates item analysis, student expectation analysis, objective analysis, & student performance; data by teacher, campus, district	▪ AEIS-IT for Statewide Data Retrieval
Data analysis	All reports generated by hand through manual sorting of scantrons	Reports generated at campus level	Data available to all staff; protocols exist for student data analysis, teacher data analysis	Statewide assessment data analyzed for curriculum development/ revision

Data Collection Procedures

When conducting case studies, it is critical to gain evidence from multiple sources of data (Miles & Huberman, 1994; Patton, 1990; Yin, 2003). Yin (2005) noted several sources of evidence that can be utilized: documents, archival records, interviews, direct observations, participant observation, and physical artifacts. This case study focused primarily on interviews and document review.

Interview Procedures

Several types of interview protocols exist to aid researchers in capturing pertinent information (Miles & Huberman, 1994; Patton, 1990). Some of these interview protocols are extremely structured, whereas others have little structure at all. The general interview guide approach is a semistructured interview format that is utilized to ensure that a specific set of issues are explored but with room to guide the conversation as it flows (Patton, 1990). In the interview guide model, Patton

observed, “The interviewer is free to explore, probe, and ask questions that will elucidate and to build a conversation within a particular subject” (p. 283). The interview protocol used with the public school districts can be found in Appendix A. The interview protocol used with CDCP can be found in Appendix B. Both interview protocols used an explanatory addendum, which is in Appendix C.

Document Review

Another phase of data collection included documentation of the data analysis done by school districts and CDCP. Yin (2003) wrote, “For case studies, the most important use of documents is to corroborate and augment evidence from other sources” (p. 87). In this study, 59 documents were analyzed from the four organizations. These documents included agendas from data analysis or curriculum development sessions; data reports analyzed by teachers or curriculum specialists; curriculum documents; and general information regarding district procedures for curriculum development, formative assessment, or data analysis.

Data Analysis

Yin (2003) noted three principles of data collection that lead to effective data analysis: (a) collecting multiple sources of evidence, (b) creating a case study database, and (c) maintaining a chain of evidence. The collection of multiple sources in this study consisted of interviews with multiple organizations as well as multiple interviews within those organizations. In addition, an extensive document review was conducted to ensure multiple sources of evidence. This section overviews the data

analysis strategies and techniques utilized to develop a chain of evidence, based on a rich database, that would allow general findings and conclusions to be drawn.

Coding the Data

Yin (2005) noted, "Unlike most other methods, when doing case studies you may need to do data collection and data analysis together" (p. 383). The first step of data analysis began within the data collection phase, in which all data were coded for further meaning.

First-level coding. The initial process that the data underwent was first-level coding. Miles and Huberman (1994) explained, "Codes are tags or labels for assigning units of meaning" (p. 56). Codes are used to retrieve and organize information. First-level coding is the preliminary process of developing and assigning codes. A major decision in coding is whether to use a preassembled start list of codes or to generate them inductively as the data are collected (Straus & Corbin, 1998). This study began with a preset list of codes linking to the four themes outlined in chapter 2: (a) data creation, (b) data retrieval, (c) data interpretation and analysis, and (d) data response.

Pattern coding. Pattern coding is used to help move beyond identification and into sense making and understanding. Miles and Huberman (1994) explained that pattern codes are "explanatory or inferential codes, ones that identify an emergent theme, configuration, or explanation" (p. 69). This process is used to take the massive first-level codes that were created and chunk them into common themes. In this study,

pattern coding was used to tease out the data from the interviews and document review to reveal the deeper themes and findings outlined in chapters 4 and 5.

Pattern-Matching Analysis

The analytic technique used in this study is pattern matching (Trochim, 1985; Yin, 2003, 2005). In this method, according to Yin (2005), data are collected and analyzed against an initially stipulated pattern to determine whether the pattern occurred "and the degree to which the conditions were substantively aligned" (p. 389). The pattern to be matched in this study was the degree to which the curriculum developers use data to inform the curriculum relevant to the strength of their organizations within the four phases described in chapter 2.

Cross-Case Pattern Analysis

Although the purpose of the case study is to understand deeply and to analyze the composition of each case, there is also merit in analyzing case against case, as is done in a cross-case pattern analysis. This specific analytic technique was used to compare the ways that the various school districts utilize data. After data were collected and analyzed within each case, the cross-case pattern analysis compared and contrasted the findings in order to find common themes or variations (Patton, 1990).

Triangulation of the Data

A major facet of data analysis is to triangulate the data, "or establish converging lines of evidence to make your findings as robust as possible" (Yin, 2005, p. 386). Triangulation has been used to add depth to research (Denzin, 1978; Patton, 1990; Stake, 2005; Yin, 2005). Stake defined triangulation as the "process of using

multiple perceptions to clarify meaning, verifying the repeatability of an observation or interpretation" (p. 454). Denzin noted several forms of triangulation, including data triangulation, investigator triangulation, theory triangulation, and methodological triangulation. The focus in this analysis was data triangulation, whereby several data sets converge to form a common theme.

In data triangulation, all of the sources of data lead to a common understanding. Where there is a nonconvergence of evidence, data points stand alone and lead to findings and conclusions. With a convergence of evidence that takes place in triangulation, all of the pieces of data (interview data, document review data, etc.) come together towards a common finding. This study utilized data from each of the evidence sources and allowed the data to converge to lead to factual findings.

Technology Usage

Several tools of technology were used in this study. For the interview protocols, a digital recorder was utilized to collect the respondent information. In addition, summaries of the transcripts were documented in electronic form to allow for ease in identifying major themes.

Reliability and Validity

Credibility

Mertens (2005) noted several key aspects in establishing credibility within a study, including substantial engagement with the respondents, persistent observations, peer debriefing, negative case analysis, and triangulation. Preparation for the research began in October 2008 through review of public documentation regarding CDCP,

document review, and conversations with regional and state leaders. When official consent was received through both the Institutional Review Board and the curriculum developers, the researcher began in-depth review of curriculum documents through early 2009. During February and March, the researcher conducted 11 interviews. Data analysis techniques were utilized and triangulation of the multiple data sources established credibility within the study.

Construct Validity

Construct validity measures the degree to which sound operational measures are utilized within the research design. Construct validity can be enhanced through gathering multiple sources of data and establishing a chain of evidence whereby an external observer could enter the data and follow a path to similar findings (Yin, 2003). This study relied on multiple sources of data; through the database created in the coding process, a chain of evidence emerged.

Internal Validity

Internal validity is used in explanatory or causal case studies in order to determine a causal relationship (Yin, 2003). As this case study is explanatory in nature (explaining how data are used to inform the curriculum), internal validity is necessary. Mertens (2005) defined internal validity specifically as the "attribution within the experimental situation that the independent variable caused the observed change in the dependent variable" (p. 254). Internal validity was evident in this study through the pattern-matching technique, which measured whether the strength of

curriculum developers in four various phases of data use led them to use data to inform the written curriculum.

External Validity

External validity, or transferability, measures the degree to which the findings can be generalized (Mertens, 2005; Yin, 2003). Although external validity or transferability never will be 100%, the use of the multiple-case research design brought added external validity to the study, as the research was being replicated in multiple cases.

Reliability

Reliability measures whether the study can be repeated with similar results. In this study, the case study protocol with the multiple sources of data, including the interview protocols and case study database, can be replicated to gain similar results.

Confirmability

Mertens (2005) noted, "Confirmability means that the data and their interpretation are not figments of the researcher's imagination" (p. 257). Confirmability in this study is exemplified through the chain-of-evidence process described in the data analysis section. This chain of evidence confirms that the data can be traced from general finding to fact to specific data points within the database.

Summary of Chapter 3

Despite much research on how data are used to identify students in need and to develop targeted interventions, there has been little research on how formative and summative assessment data have been used to inform the written curriculum. The

purpose of this study was to identify how developers of locally developed curricula and a commercially developed curriculum use formative and summative assessment data to inform the written curriculum. To accomplish this task, a qualitative methodology was selected.

The research design, including research questions methodology, has been outlined, as well as the research behind those choices (Creswell, 2007; Mertens, 2005; Miles & Huberman, 1994; Patton, 1990; Stake, 2005; Yin, 2003, 2005). The mode of respondent selection has been detailed as well as initial descriptions of the respondents.

Data collection procedures have been described for each of the multiple sources of evidence: interviews from school districts and a commercially produced curriculum provider and document reviews. Data analysis was then outlined, including both the analysis strategy (theoretical presupposition) and specific techniques (pattern-matching and cross-case analysis). The quality of research was then evaluated for credibility, validity, and confirmability.

Chapter 4: Research Findings

The underlying assumption behind this research study was that a viable curriculum is critical for student learning (Marzano, 2003). That written curriculum must be based on state standards but also must be responsive to student need exhibited through assessment data. The purpose of this study was to better understand how assessment data are used to inform curriculum development. This study was guided by two research questions:

1. How do public school districts in Central Texas use formative and summative assessment data to inform the written curriculum?

2. How do commercially produced curricular programs use formative and summative assessment data to inform the written curriculum?

Data to answer these research questions were gathered from semistructured interviews with curriculum developers from public school districts and a commercial curriculum provider, CDCP. Three public school districts ranging from 1,800 to 20,000 students were selected from the Central Texas region. Also selected was one commercial curriculum provider that served schools and students in Central Texas. A total of 11 interviews were conducted, 7 with public school district leaders who developed district curricula and 4 with staff from the commercial curriculum provider. The interviews took place at the sites of each curriculum developer, and the interviews lasted 30–55 minutes. In addition, an in-depth document review was conducted, collecting nearly 60 documents from the various organizations. The collection consisted of curriculum planning documents, actual curriculum documents,

formative assessment documents, data analysis documents, professional development documentation, and district information such as organizational structures.

Each interview was taped, transcribed, and then organized into summary documents. The data collected through the interviews and document review were then coded according to first-level coding and pattern coding (Miles & Huberman, 1994). The analysis consisted of pattern-matching analysis (Trochim, 1985; Yin, 2003, 2005) and cross-case pattern analysis (Patton, 1990). Finally, data from all of the interviews and documents were triangulated to find converging themes within the research (Denzin, 1978; Patton, 1990; Stake, 2005; Yin, 2005).

The following sections outline the findings from these methodological procedures. The findings are presented for each research question thematically with supporting information provided from the data collected.

Research Question 1: Public School Districts

How do public school districts in Central Texas use formative and summative assessment data to inform the written curriculum? There were several ways in which school districts in Central Texas used assessment data to inform their written curriculum. The clearest way was in how they used data to develop and revise curriculum documents. Two other themes emerged that spoke to *how* that development and revision occurred: how districts utilized available resources in curriculum development and how districts created a culture of data-rich dialogue. Each of the themes enabled the districts to use data to inform the written curriculum

Developed and Revised Curriculum Documents

Data were seen as a strong driver of curriculum development, both in initial creation and subsequent revision. The types of data used ranged from formative assessment data, such as district-developed, curriculum-based assessments, to summative data, such as TAKS results. The initial development of the written curriculum utilized in all three districts was informed by assessment data. In Bigtown ISD and Midsize ISD, assessment data also informed subsequent revisions of that curriculum.

One example of how districts were using data to develop and revise curriculum documents was outlined by a curriculum developer from Midsize ISD:

> We look at trends over time with our subgroups, an overview of state and federal accountability, and then zone down to objective analysis. Like knowing this is a particular objective, but what did it measure? What is the wording? What is the concept? That is followed by intensive curriculum planning. We have a side-by-side [data analysis document] where they can say, "I'm teaching this concept, but maybe I didn't teach it as I should have, based on how it is assessed" and those kinds of things. Those are district-led activities every single year.

The document review provided evidence of how this process occurred. In the case of Midsize ISD, an agenda for curriculum development included a data analysis section at the beginning outlining the steps noted above and the implications for curriculum development. Midsize ISD also provided the side-by-side resource staff utilized, which lined up each student expectation with examples of assessment items found on TAKS. Both Midsize ISD and Bigtown ISD leaders described using the data from activities like these to change the written curriculum at the end of each year.

Created vertical alignment. Vertical alignment is the process of laying out the state standards so that each skill is articulated at every grade level, K–12, to ensure student knowledge is being appropriately built upon each year. Vertical alignment is an issue within curriculum development not only because it is critical for teachers to know what is being taught before and after their particular grade or subject, but also because the TEKS are not necessarily laid out in a way that provides complete alignment from grade to grade.

When there was not a formal process for vertical alignment within the district, issues were prevalent. In the case of Smallville ISD, the district curriculum developer noted,

> They were either teaching too high on a level and not introducing the concept, and then they get to the next grade and they were still at that level, but they never got here [at the beginning], so we can't build on it. They never understood the basic foundation of what we were talking about.

The vertical alignment documents found in Midsize and Bigtown ISDs were presented in a way so that teachers could see the standards and specificity not only of their own grade or subject, but also by TEKS for the grade below and above.

Regarding the TEKS alignment within the state standards, several curriculum developers noted issues with gaps in various aspects from gaps in specificity to gaps content knowledge to gaps in performance expectations. In addition, developers noted a lack of scaffolding, or the appropriate stair-stepping of knowledge at every level. A Bigtown ISD curriculum developer stated,

> We begin with the TEKS and studying the TEKS—what does it say; what does it say for the next grade; what is the vertical articulation; when should it start. There are actual times we added elements that the TEKS didn't have

> because there was such an abrupt change into the next year that we needed them to have a lead in.

Data were also used in this piece as districts looked at assessment data and changed the written curriculum to ensure student learning. A Bigtown ISD curriculum developer explained,

> If I know we are weak in one area in third grade and there is really not a vertical line back to first grade, I have to look and see what the TEKS are building up to that. They are going to see them is first grade, second grade, and by the time they are tested on TAKS in third grade, they have seen those a couple of times.

Several developers from Bigtown ISD described how they would use this data to go back and add further depth into various grades to ensure alignment.

Determined scope and sequence through bundling. The TEKS are a set of standards that outline the knowledge and skills required of every grade or course. They are not, however, organized or grouped in a meaningful way for teachers or students. It is up to local districts to determine the scope (to what depth) and the sequence (in what order and for how long) each of the TEKS will be addressed.

One strategy noted by curriculum developers in two of the districts was to "bundle" or "chunk" the TEKS into 1-week or 3-week curriculum bundles. The bundles examined from Midsize and Bigtown ISDs included the number of days and weeks in each grouping, the student expectations to be covered, the TAKS Objectives to which the learning was related, and specific examples or specifications for each TEKS.

Both respondents from Midsize ISD also noted that data were used to develop these groupings. One said, "We work on our curriculum documents and alignment

documents—we have 1-week bundles and 3-week bundles, making them all living documents that are revised and reviewed annually based on different pieces of data." The data utilized for this process, according to the Midsize ISD curriculum development agenda, involved examining various reports from the state assessment data, TAKS.

Data were used in the development of the bundles in several ways, from proportioning the amount of time dedicated to each student expectation, to analyzing the context of instruction, to identifying curriculum projects to eliminate. Various curriculum developers from Bigtown ISD discussed this use. One noted,

> As we look at new sets of data, we have got to go back and look at where do we teach it; how do we teach it; did we give it sufficient time; and did we teach it in the manner in which we need to teach it?

Another said,

> The written curriculum did look, even in the initial stage, at those student expectations for which we traditionally didn't do very well in and tried to emphasize those. In the beginning, we looked for the areas that we needed to spend more time. That sometimes takes away from the teacher's pet projects because we also learned that teachers are teaching things that really weren't in the TEKS because they always taught them, or loved to teach them. Taking those things out and spending more time—that will be an ongoing process.

One final issue regarding the development of a scope and sequence is the actual placement of units. Data were used in these decisions as well, as a Bigtown ISD developer stated,

> You are also looking at your data; which are the hardest hitting ones and when is your TAKS test for that subject? They have to be done before the TAKS test. You don't have a year. You have until February for some, March for some, and April for some. You look at all that. You look at your trend data . . . if these are constantly our hard hitting student expectations, should we devote

> more time to those? Should we spend more time here? It is kind of a balance by data.

The bundling process that occurred in both Midsize ISD and Bigtown ISD was based on various points of data. For Midsize ISD, the data came primarily through the state assessment data; for Bigtown ISD, the data came from both TAKS and locally developed, curriculum-based assessments. This data use was an integral part of curriculum development.

Added specificity into curriculum documents. The TEKS are the state standards to be taught in all classrooms, yet in some instances the specificity needed to truly direct teaching and learning is lacking. This was pointed out by the Smallville ISD developer:

> What we have seen is interpretation of TEKS is a problem. Even though the district had its own curriculum and we had teachers involved in writing that curriculum, the way that team wrote the objectives and how we were going to teach it was very generalized. For teachers to really pinpoint exactly what they were supposed to be doing at that grade level has been proven to be difficult.

Developers noted that they most often added specificity to their curriculum documents in the initial development stages. The process utilized by Midsize and Bigtown ISDs developers involved multiple teachers from each grade level. The teams developed curricula simultaneously so that consensus could be reached as to how each student expectation should be specified. A Bigtown ISD curriculum developer explained,

> In the TEKS, there is quite a degree of ambiguity. When they have statements like "such as" our teachers are filling out what happens at which grade level. Since they are all in the room at the same time, they can turn to the table before and after them and say "what do you do," and "what are you doing," and "who teaches that." So they negotiate through looking at the places where

> it is not clear and where we want to add more specificity. Through that lens, although there is not a lot of formal data used, there is also "oh I didn't know that," "maybe that wasn't clear," or "gosh—look it says something a little different from what we thought."

The developers from both Midsize and Bigtown ISDs described how they used data to identify the areas in which greater specificity was needed and then worked collaboratively to add that specificity into the written curriculum.

Some of the district leaders also noted how this occurred in the revision process. In these cases they would use the data analysis reports to find the weak areas and look into the curriculum to see, as one said, "if there was something there that led them down this path, or [whether] everybody [was] guessing." A developer from Bigtown noted that from that data, adjustments to the curriculum are then made. This specificity was seen within the vertical alignment documents and the curriculum bundles for Midsize and Bigtown ISDs.

Identified and corrected curriculum gaps. Gaps are found in all aspects of the curriculum, from horizontal alignment to vertical alignment; from the TEKS to the curriculum documents developed by the district; and among the written, taught, and assessed curriculum. Several districts noted the power of using data to identify those gaps and remedy them. A developer from Midsize ISD stated,

> Knowing where those gaps are in the TEKS and in the written and taught curriculum is very important. We spend time every summer doing an analysis [of the state assessment data] to determine where our gaps are based on [the] data and what we need to do.

One of the curriculum developers from Bigtown ISD noted how formative assessment data were also used to find and remedy those gaps:

> We have curriculum-based assessments, and every time those come in, I'll make notes of what the trends were across the district; see where the rogue ones were. Then I'll go back and see if there is a hole or not, and whether it should be revised. Also, things you look at and you find it is weaker than you thought it would be. Where can you incorporate it in that same year, or bring it back in so they are going to hit it again.

The documents reviewed from Bigtown and Midsize ISDs evidenced this type of analysis through data analysis reports and curriculum development agendas.

Guided formative assessment development. Formative assessment served as a component of the curriculum in all three districts by guiding the acquisition of data responsive to the curriculum. Developers in Smallville and Bigtown ISDs described how data were used to develop these curriculum-based assessments.

Smallville ISD leaders chose to create district-wide assessments in solely mathematics, the district's weakest area. The data not only guided them in the content areas in which to focus, but also in the student expectations in which to target. The Smallville ISD developer noted that the math curriculum benchmark went by the Year-at-a-Glance document, "and then it went by [according to our smart goals] our greatest area of needs." This sentiment was echoed by a developer in Bigtown ISD:

> We made some decisions on our CBAs to test the most problematic SEs [student expectations] and the ones for which kids don't do as well. There is a little tension because sometimes our scores don't look real good. We can test the easy items, and we could easily make our scores look better, but that wouldn't inform our instruction like it does when we test the ones that we have not traditionally done so well on.

The document review supported these findings. Formative assessments and answer keys were obtained from Smallville ISD and Bigtown ISD outlining which student expectations were chosen and the number of questions that were targeted for

each. In addition, Bigtown staff provided a student expectation checklist that outlined each student expectation for the assessment, highlighting the critical student expectations based on data analysis.

Adjusted to state changes. Numerous actions from a state level impact curriculum development: TEKS adoptions, TEKS revisions, adoption of instructional materials, and new standards such as College Readiness Standards (and the English Language Proficiency Standards. A developer from Midtown ISD described how they respond to these changes:

> As new adoptions come [we respond to those changes]. Last year we did a complete overhaul on math. So we are trying to be responsive as the state curriculum changes or new adoptions come: How does that fit into our project and our process?

In the case of Midtown, the adoption of instructional materials prompted a complete rewrite of all of their curriculum documents. Midtown interviewees also discussed upcoming curricular projects due to the recent adoption of new English language arts TEKS and the upcoming science TEKS adoption. This planning and response to state change was also evidenced in the planning calendars in Bigtown ISD that noted each of the upcoming changes at the state level and the district-level plans for response.

One of the questions on the interview protocol asked each district curriculum developer what prompted curriculum revision. Several of those drivers included changes at the state level (see Table 3). Each change from the state level has the potential to impact student achievement. Each of the districts referenced how they used data in response to some of these changes in their curriculum development.

Table 3

Curriculum Revision Prompts for Public School Districts

District	Curriculum revision prompts
Smallville ISD	Curriculum has not been revised since origination (2004)
Midsize ISD	New TEKS Textbook Adoption Performance Data - TAKS New Courses
Bigtown ISD	Revision schedule New TEKS Revised TEKS College Readiness Standards Textbook adoption Feedback through curriculum Web site Performance data: TAKS Performance data: CBAs New enhancements New leadership Best practices Intervention needs (response to Response to Intervention)

Utilized Available Resources in Curriculum Development

It was evident that district curriculum developers used assessment data to develop and revise curriculum documents, thereby informing the written curriculum. The data also evidenced the process they used. One way in which they used data to inform the written curriculum was through utilizing available resources in curriculum development.

The process of curriculum development, revision, and maintenance described by the school district developers was immense. District leaders had to be strategic in the way they utilized resources to respond to the data within the curriculum. Often,

one of the inhibitors to being successful in using data to inform the curriculum was a lack of resources. As an administrator from Midsize ISD noted,

> We've made a push . . . to really make sure that what we are supposed to be teaching is what we are testing and that those two documents coincide with each other—it's a struggle. To be honest with you, there are not a lot of things out there on the market that help us make sure that those two things are commingling. That is one of the things that we've taken a year off on and tried to regroup on.

In the case of Midsize ISD, they actually stopped developing and administering CBAs because of this lack of resources in personnel, technology, and assessment content. Smallville ISD was also impacted by this lack of resources in the assessment realm of curriculum development:

> [I gathered my assessment items] from TMSDS [the Texas Math and Science Diagnostic System], and there were some old assessments around here that I used. Basically what I did was I would look at the grade level. I looked at the third-grade released test. Then I would look at a second-grade TEKS. Then I would try to adapt that question to a third-grade question to a second-grade level.

This Smallville developer created 24 assessments this past year (two rounds of K–12 math) with minimal resources. She also developed TAKS-A, TAKS-M, and Spanish versions of those assessments. Lacking adequate resources, she noted that there was a huge impact on her time and ability to tackle other pressing initiatives.

Two strategies were specifically noted to facilitate the process of using data to inform the written curriculum, both overcoming some of this lack of resources that impact time and personnel. The first strategy was working collaboratively within and among the school districts. The second was seeking technology solutions to ease the time and energy that curriculum work and data analysis entail.

Worked collaboratively. Interviewees from each of the districts described the importance of personnel in curriculum development. The larger the district, the more resources were available for curriculum development and data analysis. The leaders at smaller districts also utilized data to inform their written curriculum, but they did so collaboratively, both in initial development through area consortiums with other school districts and in curriculum revisions through teacher groups within their own districts. A Midsize ISD developer explained,

> We had 52 teachers [involved in the curriculum consortium]. They met multiple times and started out with just looking at what we are supposed to be teaching, and more importantly, what *are* we teaching. They lined the walls with how many times they taught a certain concept over and over; are we starting at the beginning of the year and everyone is reteaching the first 6 weeks of what they should have learned last year—those kinds of things.

Smallville also went through a similar process with another local curriculum consortium, where groups of teachers developed the curriculum collaboratively.

Curriculum developers from the larger district also noted reliance on collaborative development in the development of both the curriculum and formative assessments. A Bigtown ISD developer stated,

> We have our formative assessments that are called curriculum-based assessments or CBAs. Those are written by our coordinators, and then we bring teams of teachers in to review them, look at the questions, and make sure they are aligned to the period of time over which the assessment is taking place. We make some revisions to those documents so that they closely reflect [the curriculum].

By working collaboratively, districts efficiently used time and resources. Moreover, district leaders were able to build capacity within their own staff to deepen

the level of curriculum understanding in the district. A Bigtown ISD interviewee stated,

> The other thing that is happening as teams of teachers come together is that it is the best professional development there is. Even if you could go buy something, it lacks the ability to help teachers understand it better. That internal process serves two purposes: it dipsticks where we are in the curriculum; it gives teachers a way to measure where their kids are but it also helps grow capacity among our core teachers.

Evidence of this collaborative work could be seen through the document review of the curriculum documents from Smallville and Midsize ISDs, the staff development calendars for Midsize and Bigtown ISDs, and the CBA review session materials for Bigtown ISD.

Sought technology solutions. Whether currently searching for, beginning implementing of, or already utilizing a technology system, interviewees from each district noted the important role of technology in aiding the process of using data to inform curriculum development.

The two smaller districts were both seeking a technology system to aid in the data analysis process. The developer from Smallville ISD shared,

> Unfortunately, we use, from fourth grade up, scantrons. On the back, it went 1, 2, 3, 4, 5, according to ethnic groups. Then we also did economically disadvantaged was 6, special education was 7, [limited English proficient] was 8. Then it was taking those scantrons and literally grouping them and counting how many total, how many percentage—that is still how we are doing them.

This process was mirrored in Midsize ISD: "Basically what is happening now is that teachers are hand-scoring tests. We have a spreadsheet that we developed that has the objectives on it, and they are counting who missed what." The developers from both of these districts reiterated the critical need for technology in their ability to

effectively implement a formative assessment program, analyze summative data from the state, and utilize that data to inform the written curriculum.

Solely having a technology system was not the only answer. Midsize ISD recently had a technology system that did in-depth data analysis, offering individual student data as well as teacher, campus, and district data. A Midsize ISD curriculum developer noted, however,

> The program was really hard to use and . . . we don't have the support for it that it requires. The manpower it was taking to scan those tests was killing us. That is why we are getting away from that. We are looking more now for some [system] where we can do online assessments and paper/pencil assessments and where the released test items are already built into that system.

Bigtown ISD had a very thorough data retrieval system with the capacity to produce complex data analysis. A Bigtown interviewee explained,

> Since we can go in and we can tweak and manipulate the data, instead of going Questions 1–21, we can clump them by SE [student expectation], and that is all about drilling down to that student expectation level. We have 3 questions per SE and with [our technology program] it gives us an item analysis of Questions 5, 8, and 12. We can look at the percent correct, the districts answered, and then we want the teachers to look at the campus and their classroom, each question and the overall SE. If the overall SE is in the 80s, that is great. Is there something about a question that your kids scored low on? Let's look at what verb of that TEKS was assessed.

The impact that technology can have on retrieving data is huge. As the developer in Smallville who single-handedly sorted scantrons for the entire district by various student populations noted, "People don't understand why there is not a good turn around [in 30 minutes]." Contrast that to the ability of Bigtown with the massive data system at their disposal:

> It's literally as fast as it takes them to bring it here. The wait is always the campus getting it here. . . . Once it is here, it is 20 minutes. Once they get back to the campus, it is posted. . . . As soon as it is posted, they have historical [data], and they can look back at all their TAKS and CBAs.

The impact of technology was also seen in the document review. There were hand-generated data analysis reports from Smallville ISD, no formative assessment results from Midsize ISD, and a plethora of in-depth reports from Bigtown ISD. When considering how data are used to inform curriculum development, it is clear that technology has an impact in the time efficiency and quality of data gathered.

Created a Culture of Data-Rich Dialogue

One of the barriers found in the literature to using data for any purpose was in the lack of trust educators have in working with data (Ingram et al., 2004). The districts that were well on the road to using data to inform curriculum had done so by first creating a culture of data-rich conversation. The developer from Smallville stated that working the data "gave us all common ground as to what we are talking about and why. It builds understanding." Developers in each of the districts described the challenge of creating an environment where data could be used to inform the written curriculum. The data pointed specifically to five ways in which the districts created this culture and allowed teachers to deeply embrace a culture of data-rich dialogue.

Moved beyond pass–fail. One of the aspects critical for teachers and administrators alike in creating this culture was to move past the pass–fail mentality of data analysis. The developer in Smallville ISD noted she wanted to ensure that the campuses were getting the data back in a way that they could really use it:

> What they have been used to doing prior was just pass or fail. We didn't really know why we were passing or failing—what the reason was behind that. This year . . . we gave them the data looking at [student] population groups, looking at objectives, and how students did per objective, things like that.

The developers in all three districts noted the challenge in moving teachers and principals beyond looking at just passing rates. A Bigtown ISD interviewee described how they involved students in this discussion as well:

> On our data analysis, you can lump those three questions together. Say it was the same student expectation—did the kid know it all three times? Did he know it twice and not once? If so, what was different about it? We want kids to look at "do I know this standard?" not "did I pass or fail the test." I'll tell you, that is an uphill battle. They want to see if they passed or not: "Did I make an A or did I fail?" We really want to look at it as to what they mastered and what do I need to work on at the student level, the teacher level, and the campus level. That is how our data analysis form guides them.

Bigtown ISD has made a solid push towards this endeavor and has created student data protocols that walk the students through their own data analysis. The protocol not only has students identify trends in their performance, but also includes questions for students prompting reflection and future action plans.

Leaders at each of the districts described how they first had to move all stakeholders beyond this pass–fail mentality to get deeper into the meaning and impact of the data. Only when this aspect of the culture was achieved were districts able to use the data to inform the written curriculum.

Eliminated blame. Creating a culture where data can be freely discussed begins with eliminating the notion of blame and establishing a culture of trust. In this way, data can be seen objectively and used to examine the curriculum and identify gaps, enhance vertical alignment, and guide assessment. Blame came out in various

respects in the interviews as district leaders sought to eliminate blame on various fronts.

One area of blame was in teachers blaming their colleagues for knowledge not gained in previous years. The developer from Smallville ISD noted,

> We also found that [teachers] thought the kids learned that last year. So now what do we do? It's not just blame and assign responsibility to anyone but rather to say, this is where we are and this is what we need to do.

Another avenue for blame that was difficult to overcome was in blaming the assessments. The Smallville ISD developer noted,

> We are trying to get rid of this blame game. Oh, well, everyone did poorly because the test was too hard. Everyone did poorly because the spacing was too close to the first answer. We are trying to get away from that to say, now we have two tests. OK, but for some reason on both of those tests, they all scored 37% right here—why? The questions weren't the same. Why? Why else? Okay, the question was bad, but why else? . . . There's not blame like there was in the beginning. There is some accountability. They are starting to take on some ownership of it. And what can we do and how can we change it? Those conversations are starting to happen.

Students also received blame. A developer from Bigtown ISD described the quest to overcome this issue:

> We are really working hard on how to provide institutional responses to what we do if kids don't get it. Often, this is the quadrant where we blame the victim. We say the kid didn't try, they didn't come to tutoring, or their parents moved, you fill in the excuse. We haven't always, at school systems, taken responsibility for this piece.

Finally, the district leaders noted that administrators needed to be leery of assigning blame to teachers:

> Teachers just want to do a good job—they want to make As. If their data comes back less than good, it is really easy for them to be defensive about it. We've got to take a stance that everyone is doing the best they can but to help them move into being more reflective practitioners. To say, "I did the best I

> can but it didn't work out very well" without feeling like anyone is going to punish them—but then going back and saying, "What am I going to do differently?"

In developing a culture in which everyone is free to discuss data in ways that ultimately inform the written curriculum, it is critical for blame to be omitted from dialogue. As a developer from Bigtown summarized, overcoming this obstacle is a challenge:

> That is hard to get the teachers to understand. It is not a gotcha or an "aha!" It's like, this is what we are struggling with. The CBAs are supposed to be data to inform instruction. It's not necessarily, "The kid made a 70." It's more, "In my class, how did I do? Are my kids mastering these TEKS?" If they are, great! If they are not, go back and reteach and pull those small groups back in.

It was not until teachers got beyond the "gotcha" mentality that they were able to truly use the data in an effective way, both in the classroom and in informing the written curriculum.

Facilitated ownership and buy-in. In creating this culture of data-rich dialogue, district curriculum developers discussed the impact of ownership and buy-in to the depth to which teachers were willing to use data to inform the written curriculum. As important as it is for teachers not to blame each other, the documents, the assessments, or the data, it is just as important that they take ownership of the process of data analysis and curriculum development. A Bigtown ISD interviewee stated,

> I really see the extent that we are able to maintain the teacher engagement in the process though our [formative assessment development] reviews. I think the curriculum work goes hand in hand with that. That is really the biggest challenge that we need to maintain. That increases the buy-in and that increases the likelihood that teachers will not discount the results. They will look at it with open minds.

Curriculum developers from each district discussed the need for ownership with everything from developing curriculum documents to developing formative assessments to analyzing data. This was evidenced in the document review as groups of teachers were involved in various aspects of curriculum development in each of the public school districts.

Allowed time for change. Data are easily used to find students in need of assistance. They can be utilized quickly to develop interventions for students. However, when data are used to change the way teaching and learning occurs, including the way curriculum is developed, the change is huge and difficult. As a developer from Bigtown expressed,

> Schools have long been loosely coupled organizations where "I close my door and I do what I know best." We are messing with their lives. That is comfortable for some but not so comfortable for others. It is a process to change the dynamics of a school system and how we interact and that we are mutually dependent upon one another.

Although this administrator was referencing classroom instruction, the mind shift begins with teachers accepting the written curriculum into the fabric of their daily planning.

Each school district discussed the "mind shift" that has to occur in order to use data in an in-depth manner. A Midsize ISD curriculum developer discussed how practice needs to change: "Our biggest hurdle is getting over the way we've always done it. There are some great things out there that we need to look at and make a mind shift and change." The developer from Smallville ISD described that the community needs to change: "We can be protective and at the same time empower

our children. . . . That has been a huge obstacle in getting the community to understand that changes have to take place." A Bigtown ISD interviewee described the impact on everyone in the system:

> It's a total mind shift for folks. We are asking people to do things that are certainly that our veteran teachers weren't trained to do. Unfortunately, even our novice teachers aren't coming out of school knowing how to do that. School districts everywhere give a lot of lip service to data-driven decisions, but in reality changing practice in the classroom on a daily basis is a really hard thing to do.

The degree to which districts fostered this change and allowed time for this change influenced the degree to which a data-rich culture was built.

Supported professional development. Teacher capacity is critical within every aspect of curriculum development and data analysis. A developer from Midtown ISD expressed the need for even further professional development:

> There is still education that needs to go on with data. We talk about data-driven decision making; we talk about how we use data. The connection that I see missing is the heart of teachers taking class data and taking individual student data—they can tell you what it is, and they can tell you a kid is struggling, but making it impact the curriculum and making changes in response to where kids are [is different].

Professional development also was needed in the various components of curriculum development, formative assessment, data retrieval, and data analysis, all of which are critical for ultimately using data to inform the written curriculum. The Smallville ISD curriculum developer discussed the need for professional development on the TEKS themselves. Midsize ISD interviewees discussed the importance of truly understanding the curriculum development process, through the professional development they provided. Leaders at Bigtown ISD described some of the

professional development they facilitated in order to ensure reliability and validity on their CBAs. One Bigtown interviewee explained, "We did some training with Educational Testing Service this year so that we learned a little bit more about good, how to write good questions and how to test the validity."

Ultimately, the professional development needs to be geared towards using data to impact curriculum and instruction. A Bigtown ISD curriculum developer eloquently noted,

> We want data to inform instruction. While we are providing quite a lot of data now, one of the things we need to do is considerable professional development with, "So now what?" As in some cases it is, "That's what they know, that's what they don't, and we're marching on."

Developers at each of the public school districts acknowledged that professional development was critical to sustainable work. This commitment was further evidenced in the staff development calendar for Bigtown ISD noting the assessment training and other professional development activities and in Midsize ISD's calendar and professional development training materials on assessment.

Research Question 2: Commercially Produced Curricular Programs

How do commercially produced curricular programs use formative and summative assessment data to inform the written curriculum? The commercial curriculum developer that was studied utilized assessment data in many ways to inform the written curriculum. Like the public school districts, the clearest form of that data use was in the development and subsequent revision of curriculum documents. In addition, two other themes emerged showing *how* assessment data were used to inform the written curriculum. The first of these themes focused on the

utilization of resources, and the second analyzed how the developer worked with other districts to help them use their own data to inform their written curriculum.

Developed and Revised Curriculum Documents

Statewide performance data from the TAKS were a critical piece of data used to inform the CDCP curriculum documents. As one CDCP developer noted, "we evaluate that state data every time it comes out." Regarding the specific use of this statewide data, another developer noted,

> Prior to writing of the vertical alignment documents, we looked at all of the TAKS tests that had been released, and we looked at the data analysis that came out with each one of those scores—each one of those grade levels. We looked at where our students were struggling and we made sure that we made ties to that within our curriculum. We tried to incorporate some of those throughout the year, and we tried to make teacher notes over to the side, and we tried to address misconceptions where we saw errors being made.

One of the documents referenced in that quote was a TAKS Side-by-Side Item Analysis, which took every TEKS and showed assessment items from the 2003, 2004, and 2006 released TAKS. The document analysis tool also included the statewide performance data for each TEKS. The second phase of that data analysis segment was a planning document that had developers analyze those questions and data, write reflections, and make notes for curriculum development planning.

While CDCP has access to state data and utilizes such data to inform their written curriculum, one of the challenges in using only assessment data was a lack of direct linkage between the performance of the curriculum product and the performance of students on assessment data. Even in cases where they have collected

assessment results from CDCP schools, establishing a causal effect has been difficult due to the varying degrees of implementation:

> Implementation is key. Our problem is that we have not had enough time to really study and reevaluate the study of the implementation strategies of various districts. We have seen some that have reported huge spike gains in math or science. They are talking about these enormous gains after they have [CDCP]. That can make me feel good, but I still want to know, was that because you use [CDCP] with fidelity and did everything the recommended way? Were their teachers forced to use lessons? I would want to dig deeper where I understood. How did you implement this system? Did you really go and use the lessons? Or did you just use part of it, and it happened that one part turned the tide. Did the instruction that we provided as a model really make a difference or not? Did people flat line? How did they use the products? What did they do that caused the flat line or spike?

Although CDCP staff are striving towards obtaining a more direct link between state performance data and the effectiveness of their curriculum product, statewide performance data were still a critical driver in curriculum development.

> The vertical alignment, the instructional focus document, and the lessons have to be responsive not only to the TEKS and the SEs [student expectations], but what we know about how students are assessed so that we ensure that students have enough access to the learning opportunities prior to being assessed on that particular item. As TAKS test are available, that specificity is updated and down the line in the different documents to ensure that [CDCP] has provided the supporting materials for a teacher who is implementing this in their classroom so that students have access to that learning opportunity.

Often this process was very formal, as noted from some of the previous developers. However, on occasion, the process was more fluid, as one CDCP interviewee explained:

> [One of my developers will] get some data and she'll call me. She asks me, "What does this really mean?" And we might have a 45-minute discussion on it, and we'll write it down, and if it is something we can address in the review cycle, we'll do that. We've done a lot of improvements from that.

The curriculum documents that were informed from these data elements include vertical alignment documents, TEKS verification documents, year-at-a-glance documents, instructional focus documents, and exemplar lessons. In addition, data were used to add specificity; identify and correct curriculum gaps; and adjust to state and national changes in standards, assessments, and adoption of instructional materials.

Created vertical alignment documents. The vertical alignment documents in CDCP included a 3-year analysis of every TEKS for each core content area. The document included the focus year of instruction with the previous and forthcoming subject or grade on each side. For every TEKS, the document included the actual knowledge and skills statement as well as supporting information clarifications from CDCP. The vertical alignment document is one of the foundational documents for CDCP, as a developer noted:

> The core component is the vertical alignment document, where the TEKS are given specificity. It pulls out the verb level, so the teacher is focusing on what the actual expectation out of this student expectation, what level we are expecting kids to get to. Then it also gives the teacher some specific components [on how the TEKS] should look like from the grade level so there is more clarity around how it should look from grade level to grade level.

The purpose of the vertical alignment document is not only to make the teacher aware of the learning before and after, but also for the developers to ensure that the learning steps are appropriate: "In the vertical alignment documents, we aligned the TEKS vertically so you could stair step as a student through the instruction of mathematics to make sure there was not a gap in learning."

Developed TEKS verification documents. The CDCP TEKS verification document outlined where each standard of TEKS was taught. As a developer noted,

> TEKS verification documents are also created. That is a layout where you see each 6 weeks, where you will see the notation: Is it directly taught that 6 weeks, or is it an ongoing? Is it a process TEKS? Is it [an] ongoing skill that is covered in all of the 6 weeks or 5 of the 6 weeks?

The science TEKS verification document reviewed specified not only the bundle within the grade that the TEKS is taught but also which TEKS were taught in other grades. Developers noted that they analyzed state assessment data to determine areas in which scaffolding needed to be added to build a comprehensive curriculum. These additions were evidenced in the document review.

Determined scope and sequence through bundling. In CDCP, this bundling function is done within the Instructional focus document. The developers reiterated the need to package the TEKS in a way that makes sense for teachers:

> We didn't want to teach TEKS in isolation of another TEKS. We wanted to bundle our TEKS. . . . That is where our teachers really struggle. They think the TEKS from the state is what they should be teaching. What we wanted to do was create bundles of instruction that made connections for kids in mathematics.

The instructional focus documents examined had various segments with a variety of purposes. One CDCP developer outlined the aspects and functions of the document:

> We looked at the development of the IFD [instructional focus document], the performance indicators that would go with those, identified some misconceptions the kids might have, look at the vocabulary they might have, the guiding questions that would be appropriate for those performance indicators, and identified the TEKS that went with it. We then wrote a rationale for that unit, as to why the TEKS were bundled.

Data were a critical driver in the development of these documents. This developer noted how areas of weakness derived from the state assessments were targeted to ensure that the curriculum products were hitting that standard:

> The data [are] not just about the rates of passing. It is more about if there are the same areas of weakness [objectives]. How can we address that in our bundling and in our supplemental pieces or enhancements? So we use that to look if our product is on target with supporting the districts. Or, are there some things we need to change, modify, or enhance to help them?

This was further evidenced in the data reports and side-by-side analyses that were examined.

Added specificity into curriculum documents. Developers from CDCP realized, according to one interviewee, that "teachers didn't really have clarity of the TEKS. We decided that we would add specificity as to what that TEKS truly meant in the classroom for the teachers to use." With that, they used data to tease out the level of specificity needed in each of the documents. This developer walked the researcher through one of the curriculum documents highlighting how the specificity was added:

> This is our actual state standards right here. This is the knowledge statement and there is the SE [student expectation]. Everything in blue are things that we added for the teacher. One of the things that I think is so dynamic is that the teachers have never really paid attention to the verbs. The verbs really tell you the rigor. Here is the concept, but what are they going to do with the concept? . . . Through [working] with teachers throughout the service centers and throughout investigating the questions that came from TAKS and everything, we began to add specificity that showed you what that meant in the classroom.

One of the challenges in adding specificity was the number of requests from CDCP clients.

> There are so many clients. There are a lot of requests for specificity. Data for everybody [are] individual. "In my district, here are our gaps, here are our different student populations—what are the specific needs for us?" We are

> trying to provide a foundational, exemplar lesson, a model with the appropriate level of rigor within each.

Through the feedback mechanisms in place within the curriculum system, CDCP was able to address many of these gaps identified through data review in their curriculum documents.

Identified and corrected curriculum gaps. The focus for CDCP in this area is remedying gaps within the curriculum documents. One CDCP developer stated,

> The whole reason you have [CDCP] is so that everyone is clear what the standards are and what are the different levels of that standard for different grades so that we can ensure [learning]. There are going to be gaps because different students have different needs, but overall we are aligning so there are not gaps.

Sometimes, this alignment means actually adding to the state standards in various grades to scaffold that learning. One developer described looking "through gaps and holes. Realistically, for them to do this in this grade, we really need to put this introduction a little earlier. We'll bury it in there. That is our vertical alignment."

Data were big drivers in this initiative as well: "We look at [data] statewide. . . . There are a lot of trends in performance that I know from our own region, which seems to be very representative across the state. Those [trends] were evaluated as we were identifying the gaps."

Developed exemplar lessons. Another feature of the CDCP product is the inclusion of exemplar lessons within each unit. An interviewee explained, "The instruction is a scripted lesson, with materials, vocabulary. It follows the 5E model—it has notes for the teacher. They are meant to be examples of what those bundles may look like in the classroom." This "5E" instructional model was evidenced in the

exemplar lessons reviewed, each structuring the lesson with these five phases of instruction: Engage, explore, explain, extend and evaluate.

The selection of which lessons to include also has been driven by data. As one CDCP developer noted,

> Anything that comes out that is data or guided towards any of those assessments, we check up on it. We look at anything that is statewide. If we start seeing we've only had a few questions, we look through them and we look back at our lessons. Did we do a good job? Did we give them the tool to do that?

Not only are specific lessons chosen because of weak student performance, lessons also are targeted in areas where teacher content knowledge might be a challenge: "Identifying where teachers need to strengthen content knowledge, teaching skills—we've done that [through] identifying gaps, but also through data analysis. When I say data analysis in that aspect, I mean in performance of students in TAKS." The CDCP developers discussed targeting specific TEKS for the exemplar lessons based on the state assessment data they were analyzing.

Adjusted to state and national change. CDCP developers not only responded to changes from the state level (such as new and revised TEKS and new standards like the College Readiness Standards and the English Language Proficiency Standards), but also responded to changes at the national level (such as the National Standards in Science and Mathematics). One developer from CDCP noted, "Any time we are attending a state meeting and we find something new is coming out, like the College Readiness Standards, immediately we go back and evaluate those—where are they in [CDCP]."

This was evidenced in the interviews. Table 4 lists the responses CDCP interviewees gave as to what prompted curriculum revision for their organization. Of the 14 prompters noted, over half emerged from state and national changes.

Table 4

Curriculum Revision Prompts for Commercially Developed Curriculum Provider

Organization	Curriculum revision prompts
Commercially Developed Curriculum Provider	Revision schedule New TEKS Revised TEKS New courses (4x4) College Readiness Standards TAKS information booklets TAKS study guides National standards Performance data: TAKS New enhancements Adoption of English Language Proficiency Standards Best practices/research Feedback through curriculum Web site Feedback from district advisory group

One of the curriculum revision drivers was TAKS information materials. Each year, the state produces a TAKS study guide with sample assessment items and further specificity of each standard. In addition, each assessment has a corresponding state-produced information guide that again offers further detail to how each expectation will be assessed.

> If there is any new data that comes out, like [when] we get the new TAKS study guides, . . . we read them. If there is any new information that is provided, like in the TAKS information booklets that are provided by the state, they have a little section in there that is called "For Your Information." If there is anything in there that has been added that we have not identified

> within the curriculum already, we immediately go in and we make that adjustment. . . . We are constantly updating it as quickly as we get the information.

Developers from CDCP noted that these data sources were used in not only the initial development of the written curriculum documents, but also subsequent revision cycles.

A state driver noted by interviewees was the Texas College and Career Readiness Standards to ensure college and career readiness of all students. CDCP quickly responded to ensure that these standards were a part of the core curriculum.

> When the college readiness standards are adopted, then what we realize is that there are gaps and there is gap analysis between here is the college readiness standards and this is what the TEKS have: What is the gap? Those are done in document form. What we will do is identify, tag it where it has already been addressed that we have already adhered to that standard, or it is missing but it applies in this unit, then we are going to fulfill that by inserting recommendations or actual activities that support the teachers to match and meet those standards.

In addition to the newer state standards, CDCP was aggressive in incorporating the National Standards. One developer noted, "We are aligned as much as we can be to the national standards as well. If our students graduate from Texas and go to college in Wisconsin, they can be successful." Another described how those standards were incorporated into the curriculum:

> We also looked at national standards. We looked at the curriculum and evaluation standards for school mathematics, which is by the National Council of Mathematics that was put out. We have all our team, every one of our team members read it. We talked about that when we looked at our grade levels.

Evidence of the incorporation of these state and national changes could be seen in various CDCP curriculum documents.

Utilized Available Resources in Curriculum Development

CDCP developers evidently used data to inform the written curriculum, and there was evidence of how they accomplished that task. CDCP developers utilized a myriad of resources in curriculum development. They used hard resources like a Web-based technology system to house their curriculum and soft resources like personnel. Two of the strongest ways they used resources in the work of using data to inform curriculum development was in their collaborative work structure and in their gathering of client feedback.

Worked collaboratively. Although CDCP is a commercially produced curricular product, the range of people involved in its development has been immense. This work involved not only full-time CDCP developers, but also curriculum writers from across the state:

> We identified a team across the state of Texas that was pretty much representative of the state. We had service centers involved, and we even had some math curriculum specialists involved—not all of them were service center members. We looked at their experience in mathematics, what they had taught, their own training experience, and what they had attended in statewide training and TEKS teams, and things like that, and then we developed our team.

One of the science curriculum developers noted that CDCP had partnered with a local university to assist in some of the upper level science courses. In each of the content areas, the curriculum work was led by the CDCP leaders but involved a multitude of developers, writers, and specialists at various phases.

Gathered client feedback. Another route of utilizing resources was to gather and respond to client feedback.

> We have actual feedback tools with each unit. A user can go to ay given unit in [CDCP] and there is an actual feedback mechanism. They can label it as a content error or content question, or it is just a grammar format or Web link doesn't work on the document. In that tool, they can submit feedback.

That feedback then is used to inform the written curriculum:

> We get data from when teachers use the lessons in the classroom, or the VAD [vertical alignment document] or the IFD [instructional focus document], any of the instructional documents within the classroom. We have a feedback mechanism within our [system] where they can actually go in, any teacher across the state of Texas, any administrator, any district using it, can go in and maybe they might have a question about the performance indicator, or a question about the TEKS, or a question on the VAD, or a question within a lesson, they can type it in right there, and it comes directly to us. We respond back. What we do when we get that, we let them know we've received it, and then we take it back to the team.

CDCP serves hundreds of districts across the state. This is one way that they have utilized resources to aid in curriculum development.

Assisted Districts in Making Curriculum Development Decisions

Research Question 2 asked how CDCP used assessment data to inform the written curriculum. While much of the data pointed to how they use assessment data to inform their own curriculum development, the data also showed how they were using assessment data to help local districts inform their own local curriculum development. The first way was through assisting districts to engage a culture of data-rich dialogue. The second way was in having district leaders think through the costs and benefits of the curriculum development process.

Created a culture of data-rich dialogue. While the data showed that the CDCP team focused heavily on data use through their internal data conversations, CDCP also has helped local districts have those meaningful conversations about their

own data. This is most often seen as districts contemplate shifting to a commercial product. One CDCP developer described, "On the implementation side, we like to begin our conversation with districts around their data. A discussion might be what we perceive their needs to be, and why they are they looking for something like CDCP." Critical to that conversation is understanding whether the written curriculum in place is serving the needs of all students:

> Part of having a curriculum is so that all students have access to that guaranteed curriculum. If only one student group is performing really well, what does that tell us about the access to the curriculum across different student groups?

The CDCP leaders who initiate these conversations have to build a safe environment to have these conversations so that district leaders can look at the big picture of their own curriculum development:

> How do we use data to make it not about the teacher but about where the school is currently and what tools and strategies are we going to put in place to move this school district forward? It helps the administrators have that conversation. It's not about anyone personally; it's about how we are looking at our data and the decisions we need to make regarding where we want to go next.

The documents reviewed in this area showed various instances of the CDCP team utilizing district data in initial conversations about the CDCP product. One opportunity was a "data-dig," a preimplementation activity that districts can choose that lead campus teams through in-depth data analysis and focused conversations on curriculum supports. Another was a portion built in to the curriculum review where district leaders analyze their own content area data and then compare CDCP

instructional focus documents to their own documents to see if their current curriculum is adequate in its depth and complexity.

Analyzed the cost–benefit of curriculum development. One of the other ways in which CDCP assisted districts in making decisions about curriculum development was in analyzing the benefits and costs associated with curriculum development.

> Why don't we create something that everyone can use? Build up the curriculum so that districts could focus on the instruction? They spent so much time on the curriculum; they never got to the instruction. How much change really happened? Yes they had a curriculum, but did that make an impact in the classroom?

CDCP developers heard from many districts across the state about challenges in the amount of time and money it took to create, maintain, and revise curriculum documents at the local level. One of their missions was to provide a product for districts that would allow district staff to focus on the core of student success: teaching and learning.

These data-driven conversations assisted district leaders in making curriculum development choices. For some, the decision was to continue on with their internal development, striving for a guaranteed, viable curriculum within their own district. For others, the decision was a data-driven choice of a commercial product such as CDCP.

> How all that relates to data, is knowing your school and knowing your data, and being able to look at it and understand the implications for where changes need to happened and not happen. Being able to drive that change and be responsive to your community, your kids, your teachers.

The implementation team for CDCP described how the data were a critical component to discussions with local school district leaders contemplating how best to

inform their own curriculum. For some districts, the ultimate choice, based on the data, was to adopt CDCP. For others, the decision was to continue developing their own and allowing data to be a critical driver of that development.

Chapter 5: Discussion, Implications, and Recommendations

Introduction

The purpose of this study was to examine how curriculum developers from public school districts and commercial entities utilized formative and summative assessment data to inform the written curriculum. A multiple-case study approach was used to analyze three public school districts and a commercial provider. Data were collected through interviews and an in-depth document review to better understand this specific data use within these organizations.

Previous studies that examined data use and curriculum development focused on using assessment data to improve teaching and learning, district use of data, drivers of curriculum development, and building a data-informed district (Boudett et al., 2005; Coburn et al., in press; Coburn & Talbert, 2006; English, 2000; Wayman et al., 2007). This study looked specifically at how formative and summative assessment data are used in curriculum development.

Discussion of Major Findings

The first research question asked how public school districts use formative and summative assessment data to inform the written curriculum. The analysis showed that they each used assessment data to guide the development of their curriculum documents. In the case of Smallville and Midsize ISDs, the assessment data came primarily through summative assessment data from the state (TAKS data). For Bigtown ISD, both formative and summative assessment data were used heavily

in the curriculum development process. In addition, the analysis showed *how* these districts were using data to inform the written curriculum. For all three, this process was aided through the utilization of available resources and the creation of a data-rich dialogue.

The second research question examined how a commercial provider used formative and summative assessment data to inform curriculum development. This analysis also showed that the provider, CDCP, used data to guide various curriculum documents. These data were also summative in nature, relying on statewide assessment data. The research responses from the commercial provider also pointed towards *how* this process occurred, through utilization of resources and assistance to districts in informing their own curriculum development. The upcoming section examines some of the findings that emerged from both of these research questions.

Finding 1: Organizational Size and Capacity Matters

By utilizing maximum-variation based on size within the respondent selection, three distinct representations of districts were examined. Coupled with the examination of a commercial entity, the disparity between the organizations in terms of their organizational size was immense. This disparity had implications on the capacity of the organization to secure and utilize effective resources such as personnel and technology as well as the organization's ability to carry through each of the phases of data use necessary for utilizing data to inform the written curriculum.

Capacity in resource acquisition and allocation. As Table 2 displayed, the organizational size and capacity of each of the four organizations varied immensely.

The number of people, the budgets of those departments, and the resources the organizations had acquired were extremely different. These resources had an impact on how the districts utilized personnel as well as how they accessed other resources such as technology.

The disparity in personnel had a great impact in the organization's capacity to effectively manage all aspects of curriculum development. As noted in the respondent description, the curriculum departments in these organizations ranged from one person in one department to over 30 people in multiple departments. Whereas the larger district and the commercial entity had multiple coordinators in the content areas who could focus on curriculum development and formative assessment development, the smaller districts had to prioritize their development and focus on a smaller number of areas of curriculum development. The document review evidenced the marked difference in capacity of these districts not only in incremental increases of documents from each district and organization, but also in the depth and complexity of such documents.

Along with personnel, technology served as another resource to which larger districts had greater access. Smallville ISD had a technology program, but it could not be loaded due to some technical issues the district was facing. Even if Smallville staff had overcome those issues, however, they were still lacking the supplemental program that would have scanned and scored the data directly into the system. Midsize ISD had a technology system previously but had not renewed the service because of the technology department's inability to support it and the inability to

maintain the work effort needed to scan and score an entire district's assessments in a department of just two people. Bigtown ISD, on the other hand, had a massive data system with an entire assessment department responsible for scanning and scoring assessment materials. Bigtown had multiple coordinators for every content area who could assist in the data analysis as well. CDCP also had a very effective data system and department staff who could produce any report needed for the curriculum developers.

Capacity to create, retrieve, analyze, and respond to the data. The literature review made the case that for curriculum developers to be effective in utilizing data to inform the written curriculum, four phases must be navigated: (a) data creation, (b) data retrieval, (c) data analysis, and (d) response. Organizations needed first to have a curriculum that was comprehensive and aligned and as well as an assessment program that was tied to that curriculum. These processes became the data creation phase, which later would be used to inform curriculum development (Chappuis & Chappuis, 2007; English, 2000; McGehee & Griffith, 2001; Perie et al., 2007; Popham, 2007). Next, organizations needed to have a data retrieval system that could pull the data generated from the various assessments based on the curriculum standards (Bernhardt, 2005; Datnow et al., 2007; Honig & Coburn, 2005; Perie et al., 2007; Supovitz & Klein, 2007; Wayman, 2005; Wayman et al., 2007; Wayman et al., 2004). This often took the form of a technology system from which data could be retrieved. Organizations also needed capacity to analyze and interpret the reports produced from the data retrieval system (Black et al., 2004; Coburn et al., in press; Earl & Fullan,

2003; Ingram et al., 2004). Finally, organizations needed to respond to those findings and actually change the written curriculum (Chappuis & Chappuis, 2007; Coburn et al., in press; Copland, 2003; Datnow et al., 2007; Doyle, 2002; Perie et al., 2007). The premise of this study was that the organizations who effectively navigated through all four of those phases would have the most success in using data to inform the written curriculum.

Organizational size and capacity was a large determiner to that success. The largest school district and the commercial entity were by far the most advanced in each stage and showed extensive documentation of how they used data in their curriculum development. Although the work of the staff in the smaller districts was commendable, their processes were not complete. Smallville ISD was excelling in its formative assessment program in mathematics but had neither the data retrieval system to produce effective data analysis nor a comprehensive curriculum for it to impact. Midsize ISD had an extremely in-depth curriculum but had neither a formative assessment program in place nor a data retrieval system to evaluate the program or curriculum. Although both of these districts used data in many excellent ways, only Midsize ISD was able to use data to inform the written curriculum, and solely through the summative results from the state assessment. Bigtown ISD, on the other hand, had a comprehensive curriculum with valid reliable assessments, a data retrieval system, and a staff trained to interpret and respond to those analyses. Although developers at the commercial entity, CDCP, had some challenges in effectively retrieving data pertinent to their product, their organizational size and

capacity made up for that struggle as they showed widespread use of assessment data in ongoing curriculum development.

Finding 2: Sustainability Is Critical

Even if an organization is able to effectively use data to inform the written curriculum, despite the size and capacity of an organization, a question of sustainability still remains. This was most evidenced in the case of Midsize ISD, where deep curriculum development and alignment work through the use of data had been done in elementary mathematics. Almost every phase had been thoroughly navigated thoroughly, and the end product was a guaranteed, viable curriculum in that area. Yet, when asked how the district was going to replicate that process for K–12 English language arts, the implementation of the English Language Proficiency Standards, and K–12 science standards for the upcoming year, respondents made it clear that the work ahead simply to keep up with the impending changes was overwhelming to the small department.

Sustainability is a critical issue because of the rate of change in the standards from the state and national levels as well as the implications of those changes to an organization with costs, including personnel and time. Sustainability also becomes an issue when considering the rapid mobility of today's students, teachers, and leaders within the educational system. This constant evolution of students, teachers, and leaders is putting a critical strain on the organizational capacity to sustain quality curriculum development and implementation.

Sustaining changes in state and national standards and policies. There is no question that education is a constantly changing landscape. Between changing curriculum standards, assessment structures and standards, state and federal accountability standards, instructional materials adoptions, state professional development offerings, and graduation requirements, change is constant. The question of sustainability emerged as organizations of all sizes grappled with keeping up with the change.

Midsize ISD staff described the personnel they had pulled together to revise their curriculum from the elementary mathematics instructional materials adoption. That work included approximately 25 teachers for 10 days at $100 a day. Although they were extremely effective at that development project, that was only elementary mathematics, and they still had to replicate that process for K–12 English language arts this year, K–12 science the following year, and social studies thereafter. Those revisions are only to adapt to the standards. The instructional materials for those new standards will not be available until years after their adoption, requiring further revision so that resources are aligned for curriculum implementation. If Midsize ISD staff were to replicate the effective process they used in K–5 curriculum development of one area ($25,000), the financial costs of two major K–12 revisions in this next year would be over $100,000.

New curriculum standards are one of the leading drivers of curriculum development. In 2009, districts will have to be prepared to implement the new English language arts and reading TEKS, the mathematics TEKS that have been

revised to incorporate the College Readiness Standards, and the new English Language Proficiency Standards that impact every curricular area (Region XIII Education Service Center, 2009). In 2010, districts will be implementing new science TEKS and new standards and courses in career and technology education (over 130 courses). They also will be receiving new instructional materials for the English language arts TEKS adoption from the year prior, which will require subsequent revision of those curriculum documents. In 2011, new social studies standards will be implemented, and further instructional materials in the areas of English language arts and English as a second language will be received. In 2012, the mathematics TEKS again will be revised, and new science instructional materials will be ready for the classroom, again prompting further curriculum revision (Region XIII Education Service Center, 2009).

These changes that will require curriculum development and revision are only in the area of standards. Massive changes are on the way in the area of assessment as well, with a move to end-of-course examinations in Grades 9–12. This change will shift the current cumulative testing cycle, which covered a portion of the standards in each grade level, to a system where every standard will be tested in a much deeper way. This assessment change will force organizations not only to analyze the depth and complexity of their curriculum documents, but also to provide another data source to inform that development.

Additionally, changes with regards to graduation standards will lead to new courses for which standards will be developed. Whereas organizations in the past

only needed to focus on Algebra I, Geometry, and Algebra II for graduation requirements, these new changes will mandate a 4th-year mathematics that might include the addition of Pre-Calculus, Math Models, Statistics, Calculus, and Business Math (Region XIII Education Service Center, 2009). These new requirements will mean new curriculum development for many organizations.

Sustaining the cost of curriculum development. Even in the case of Bigtown ISD, which was excelling in nearly every facet of curriculum development, leaders contemplated the sustainability of their work. Developers at Bigtown were keeping up with state and federal mandates but were concerned about the cost of doing so, particularly in terms of time. While the work that their curriculum team was producing was excellent, it was in place of other work that could be even more influential for the district. Bigtown ISD leaders interviewed wished their curriculum specialists could engage in modeling lessons in the classroom, serving as instructional coaches to teachers in need, and facilitating data-rich discussions with curriculum groups. Although not ready to abort the extensive work they have done, they too have had conversations about the sustainability of their work.

This notion of sustainability has moved many organizations to considering the merit of a commercial provider. One of the themes that emerged from CDCP was how they used data to inform the curriculum development of other districts. This organization uses assessment data along with a multitude of other data sources to help districts make informed decisions about their own curriculum development. The

sustainability in both financial costs and time costs is a large part of those discussions.

Sustainability through mobility. One final issue related to sustainability is the mobility of students, teachers, and leaders within the education system. The mobility rate of both students and teachers in the state of Texas is on the rise. The average stay of a superintendent in this nation is just over 5 years (Glass, Björk, & Brunner, 2000). With that mobility on all levels, the capacity of an organization to sustain the complex processes required for curriculum development comes into question.

This was seen in several of the organizations in their data of student, teacher, and leader mobility. The curriculum leader in Smallville ISD had been in that position for less than 6 months. In Midsize ISD, 1 of the 2 leaders interviewed was new to the role. In Bigtown ISD, 2 of the 4 leaders interviewed were within 1 year of their current role. Although many of the CDCP leaders had been in the organization hosting the commercial entity for some time, most were also new to their specific roles within CDCP. Further data showed the increased mobility of students and teachers within the school districts. Data from Texas Education Agency (2008) reports indicated that the mobility of students was high. In just the high schools of the three public school districts researched alone, student mobility ranged from 12.7–23.0%. The mobility of teachers is even more rapid. The Texas Education Agency (1995) reported that over half of all teachers left the profession within 5 years. In addition, those who do remain have high mobility between districts (Texas Education Agency, 1995).

One of the solutions to this mobility was offered within CDCP in the sense that the company offers a common curriculum that can be utilized in any district for any student. The developers discussed the merit of this in terms of student mobility, as they can offer a better solution for the gaps that occur when students leave one system and join another. They also discussed the merit for teacher mobility, in that teachers are walking into the same curriculum system, easing their rate of transition within the new campus. For leaders, this proposition is just as enticing, as one of the most difficult hurdles for a new leader to undergo is understanding the state of curriculum design in a district as well as bringing it to the level where it is guaranteed and viable.

Implications

The educational landscape clearly is changing, and that change will continue to have vast impact on students, teachers, leaders, campuses, and districts. Research regarding curriculum development as well as the use of data in that realm has brought two implications to light. First, a guaranteed and viable curriculum that is readily responsive to change and data information is critical in today's educational system. Second, how data are created, presented, and used within that curricular context impacts the validity, usability, and sustainability of that curriculum.

A Guaranteed and Viable Curriculum Is Critical

An immense component of the current educational landscape is accountability. No longer just a matter of whether teachers are teaching and students are learning, the current, complex accountability system is intricately tied to standards

for learning. Those standards are changing, the assessments linked to those standards are changing, the courses requiring standards are changing, and the instructional materials that guide teaching and learning for those standards are changing.

The only way to be successful within a complicated accountability context is to be absolutely clear about what it is students must know and be able to do within every step of their educational career. This can occur only through a curriculum that is comprehensive and aligned; that is built with specificity; that is analyzed through careful examination of data; and that is developed in a way that is strategically planned, responsive to data from varied sources, and carefully executed.

Develop a curriculum that is comprehensive and aligned. The notion of a comprehensive and aligned curriculum is at the crux of how Marzano (2003) defined a "guaranteed" curriculum, where "states and districts give clear guidance to teachers regarding the content to be addressed in specific courses and at specific grade levels" (p. 24). Although one might think that districts already have this in place with the state curriculum, they do not, as was seen with the work that ensued in all three of the public school districts examined. Hirsch (1996) reiterated, "The idea that there exists a coherent plan for teaching content within the local district, or even within the individual school, is a gravely misleading myth" (p. 26). Districts must develop a comprehensive curriculum to guide teaching and learning.

Specificity plays a big part in the degree to which a curriculum is comprehensive. Specificity is knowing the specific learning targets (Chappuis & Chappuis, 2007) as well as understanding the extent of the educational objective that

is to be measured (Tyler, 1949). Although the TEKS provide a framework for the knowledge and skills required for children in the state of Texas, there is work to be done on truly understanding what those standards mean and, more importantly, what they look like in the classroom. Having educators determine the specificity of each standard can eliminate the gaps that exist in curriculum programs today (Hirsch, 1996; Tyler, 1949).

Alignment also has proven to be a significant aspect of curriculum development. Not only is alignment critical among the written, taught, and tested curriculum, but it also is equally important that the curriculum be appropriately scaffolded at every level in between (English, 2000; Marzano, 2003). Once the state standards are lined out with the appropriate degree of specificity, educators need to ensure alignment with those standards. Marzano suggested districts "sequence and organize the essential content in such a way that students have ample opportunity to learn it" (p. 30). Part of that "ample opportunity to learn" includes looking for areas in which more scaffolding is needed prior to the stage at which mastery is expected. This level of work was seen in Bigtown ISD and CDCP, as curriculum developers were able to engage in in-depth curriculum analysis and add in further support at various levels to ensure that teaching and learning had appropriate scaffolding and were aligned in each content area.

Utilize assessment data in curriculum development and revision. Part of developing a guaranteed and viable curriculum is ensuring the opportunity for student success on assessments. Key to that opportunity is using data to inform curriculum

development (Crommey, 2000; Datnow et al., 2007; English & Steffy, 2001). This data use was exhibited in many ways in the organizations examined in this study. Each organization was using summative assessment data within the district or organizations, with three of the four using that data to inform the written curriculum. In addition, one organization was using formative and summative data to guide data analysis and curriculum development.

One of the ways to utilize assessment data is in initial curriculum development. By beginning with that assessment end in mind, district leaders can better develop a curriculum that will ensure student success (Wiggins & McTighe, 1998). The assessment data can be used to build vertical alignment, to add specificity to the state standards, to bundle standards in a way to make meaning for students and teachers, and to identify and correct gaps within the curriculum.

Beyond the initial curriculum development, assessment data should be continually analyzed in order to ensure that the curriculum documents are viable as the standards and assessment structures continue to change. By utilizing data in the development and revision of curriculum, districts can align the written, taught, and tested curriculum, leading to increased student achievement (English & Steffy, 2001).

Strategically plan for collaborative curriculum development. Marzano (2003) described the challenge of developing, implementing, and maintaining a guaranteed, viable curriculum: "Enacting this research-based principle of school reform is one of the most significant challenges currently facing U.S. schools" (p. 25). The final aspect

of developing a guaranteed and viable curriculum is ensuring that development is strategic and collaborative.

The planning required for curriculum development is critical to its effectiveness. English and Steffy (2001) described the planning necessary for effective curriculum work, highlighting that resources, data, and a comprehensive plan were needed prior to initiating the work. Copland (2003) also noted the merit of strategically planning major initiatives. That strategic planning includes both long-term planning and prioritization as well as short-term planning and resource allocation.

Long-term planning is the only way to ensure that an organization can respond effectively to the changes to the standards, assessments, and instructional materials. This long-term planning needs to include at least a 5-year look at upcoming curricular projects based on the slated state initiatives and overall district need. This planning must include prioritization as well, because curriculum development can be a costly endeavor in terms of both time and money.

Short-term planning is also critical (English, 2000). The short-term planning is thinking through how each curriculum development session will be executed. Long gone are the days of haphazard curriculum development. It is critical that developers ask the pertinent questions: Who needs to be there, what tasks need to be accomplished, how much time should be allotted for each task, what resources need to be gathered, what knowledge needs to be shared prior to beginning, and how will we know when it has been achieved?

Collaboration in this development process is also critical (English & Steffy, 2001; Honig & Coburn, 2005; Jacobs, 2004). This collaboration not only leads to critical buy-in and ownership, but also spreads the deep understanding that can take place when educators grapple with the various phases of curriculum development. Collaboration can lead to enhanced vertical alignment as conversations can be structured around how standards are implemented at each level.

How Data Are Created, Presented, and Used Is Important

Another implication of this research is that how data are created, presented, and utilized is important. If the ultimate goal is sustained change through systematic use of data, then the way data are created, presented, and used becomes paramount (Copland, 2003; Datnow et al., 2007). In order to deepen the work of using data to inform written curriculum, the data first must be valid and reliable, the data must be presented in a risk-free culture, and usage should go beyond the rudimentary uses of data.

Ensure that data sources are valid and reliable. Ingram et al. (2004) maintained that teachers are already prone to disassociate themselves with the performance data of their students. With any question of validity and reliability, the data are quickly discounted, which inevitably shuts down all processes involved in using that data towards substantive change.

Validity and reliability were two aspects that plagued the districts of Smallville, Midsize, and Bigtown. This was most clearly seen in their struggle to create valid and reliable assessments. In the case of Smallville ISD, each assessment

was created from a different assessment bank, leading teachers to question the validity of any comparisons of the results. Midsize ISD actually stopped administering interim assessments because of the lack of validity and reliability. Even Bigtown ISD staff questioned the depth of the validity and reliability of the deep formative assessment work that was being done.

Ensuring validity and reliability begins with explicitly matching assessment items to their learning targets (Chappuis & Chappuis, 2007). This begins with knowing which standards will be assessed at which level (vertical alignment) as well as to what degree and in what context it will be tested (specificity). Validity and reliability cannot occur in data unless such data are purposefully and carefully created within the curriculum development and assessment development phases.

Ensuring validity and reliability also can be regulated through data triangulation. Wayman et al. (2007) discussed this process of using multiple sources of data to make decisions. Organizations need to look at all of the elements within the curriculum to ensure validity and reliability: curriculum documents, formative and summative assessments, data retrieval programs, and the actual analysis to ensure that a full understanding of the data is gained.

Create a risk-free culture. The research is clear that effective data use begins with open, honest, and blame-free conversations about data (Datnow et al., 2007; Doyle, 2002; Earl & Fullan, 2003; Wayman et al., 2007). Chappuis and Chappuis (2007) discussed that particularly with formative assessment, the goal is to measure progress, determine instructional strategies, and inform the teacher. If the purpose of

data use is to adapt curriculum and instruction to better meet the needs of all students (Perie et al., 2007), then creating a culture in which stakeholders are free to discuss data in a myriad of ways is crucial. The notion of sanctions, punishments, and blame must be eliminated.

One ingredient in creating that culture is allowing time (Copland, 2003; Datnow et al., 2007; Ingram et al., 2004; Wayman et al., 2007). Time is critical in every aspect of data use: understanding what the data mean, reflecting on what that means for personal practice, and taking action to respond to the data. Organizations need to plan for specific time to analyze data prior to curriculum development and revision. Time also should be structured to allow curriculum developers to understand exactly what the data indicate.

Another strategy towards creating that environment is the process of calibration (Wayman et al., 2007; Wayman et al., 2006). This process of collectively determining group standards and norms can be essential for districts with educators struggling to embrace the data.

Move beyond elementary data use. This study generated from reflection on an earlier research study (Wayman et al., 2007) that showed how one school district was using data. One of the findings from that study was that while staff were adept at basic data uses, such as identifying students in need of assistance and developing appropriate interventions, they were lacking in other, more sophisticated data use, such as using data to inform the written curriculum. Data can be complex; data are not always easy to analyze (Coburn et al., in press).

Curriculum developers must move beyond basic data use to inform curriculum development (Chappuis & Chappuis, 2007; Datnow et al., 2007; Perie et al., 2007; Suppovitz & Klein, 2003). Perie et al. noted increasing opportunities to obtain specific data for in-depth analysis. These opportunities allow curriculum developers to engage in more sophisticated data uses, such as analyzing the depth of curriculum alignment; identifying gaps within the curriculum documents; and developing assessments that not only match the written curriculum, but also are reflective of how each standard will be assessed.

Recommendations for Future Research

Although the data collected in this multiple-case study were extensive, there are several opportunities for further research within the context of this study and beyond. This study focused strictly on the written curriculum, but there is much to be said for how that written curriculum is implemented in the classroom. As one of the developers in the public school district noted, the mantra of "I close my door and I do what I know best" is still heard, in spite of a comprehensive, district-wide curriculum. Analyzing how the curriculum is implemented in the classroom or even focusing on how the curriculum is assessed are two areas of potential research.

Within the context of the organizations examined within this study, findings could be expanded by a longitudinal study of these districts and commercial entity. At the conclusion of the study, one of the three districts had already committed to working with the commercial curriculum provider (CDCP), and in another district leaders were having conversations about their curriculum development future. A

longitudinal study could prove meaningful in understanding how these organizations cope with the notion of sustainability in the face of state and national change.

Further, much remains to be learned about the link between a viable curriculum and student performance. CDCP expressed challenges of collecting "valid, trustworthy, reliable quantitative data." Future research could analyze the depth of implementation of the curriculum to determine what impact it was having on student performance.

Conclusion

Although developing or obtaining a guaranteed and viable curriculum is only one of the factors necessary to impact student achievement, it is vital to ensuring equal access to learning. Curriculum development and data use long have been a part of schools and districts, yet the increasing pressure from the state and federal accountability systems as well as the rising number of changes in the standards and other factors impacting curriculum development have created substantive challenges for curriculum developers at every level. Prior research has shown that although data have been used in many ways in school districts, much of that data use has been focused at the student level (Wayman et al., 2007), but not necessarily towards the systemic causes of that student performance, like a guaranteed and viable curriculum.

Because the standards continue to rise and change, the development and maintenance of a comprehensive, aligned, data-informed, curriculum are critical (Marzano, 2003). This study has shown that the size and capacity of the organization are factors in the ability of a district or commercial entity to provide and sustain a

data-informed written curriculum. These factors must be overcome, either through strategically planning curriculum development internally or utilizing a commercially-produced curriculum product so that students have every opportunity to learn and achieve.

Appendix A: Interview Protocol, Public School District

1. Tell me about your role as it relates to curriculum development.
    a. How long have you been serving in this role?

2. How do you interact with data in your job?
    a. Rank the following uses of data and talk through why you're placing each (see Appendix C).
    b. Why did you place the item regarding identifying and correcting curriculum gaps where you did?

3. Describe the curriculum development process in the district.
    a. How often is it revised?
    b. What prompts revisions?
    c. Who makes the revisions?
    d. How are revisions made?

4. How is formative assessment utilized within this district?
    a. How often are district-wide assessments given?
    b. Are they curriculum-based, beginning/middle/end profiling, or other?
    c. How are the tests developed?

5. In what ways are technology systems used in your district related to student achievement?
    a. Do you use a technology system to generate data for your formative assessment program?
    b. What types of reports are generated from the technology systems?
    c. Who generates the reports?

6. Tell me about how data analysis occurs in this district.
    a. Who analyzes formative assessment data in your district?
    b. How often is formative assessment data analyzed?
    c. Who initiates the analysis?

7. To what extent are data analysis and interpretation used in defining and remedying curriculum gaps?
    a. Does this level of analysis occur at the teacher level or central office level?

8. How are changes made to the curriculum based on data?
    a. Are the changes most often made within the delivery of the curriculum or the actual written curriculum?

9. Within this whole process of curriculum development, formative assessment, accessing the data through technology systems and data analysis, what are the biggest challenges you face in using data to make changes in the written curriculum?

Appendix B: Interview Protocol, Commercial Curriculum Provider

1. Describe your role as it relates to the curriculum development of your curriculum product.
    a. How long have you been serving in this role?

2. How does your curriculum development team utilize data?
    a. Rank the following uses of data and talk through why you're placing each (see Appendix C).
    a. Why did you place the item regarding identifying and correcting curriculum gaps where you did?

3. Describe the curriculum development process that is utilized.
    a. How often is it revised?
    b. What prompts revisions?
    c. Who makes the revisions?
    d. How are revisions made?

4. How is formative assessment utilized within your curriculum products?
    a. How often are formative assessments given?
    b. Are they curriculum based, beginning/middle/end profiling, or other?
    c. How are the tests developed?
    d. How are the data used?

5. In what ways are technology systems used in your organization related to student achievement?
    a. Is the technology system for the formative assessment program?
    b. What types of reports are generated with the formative assessments?
    c. Who generates the reports?

6. Tell me about the data analysis that occurs within your organization.
    a. Who analyzes formative assessment data in your organization?
    b. How often is formative assessment data analyzed?
    c. Who initiates the analysis?

7. To what extent are data analysis and interpretation used in defining and remedying curriculum gaps?
    a. At what level does this analysis occur?

8. How are changes made to the curriculum based on data?
    a. Are the changes most often made within the delivery of the curriculum or the actual written curriculum?
    b. What challenges do you see in using data to make changes in the written curriculum?

Appendix C: Interview Protocol Addendum

For Question 2 regarding how data are used, the respondents ranked the following data uses (notated on strips of cardstock) according to how data are most often used in their organization:

- Assigning or reassigning students to classes or groups
- Developing recommendations for tutoring and educational services for students
- Encouraging parent involvement in student learning
- Evaluating school/district achievement trends and performance
- Identifying and correcting gaps in the curriculum
- Identifying individual students who need remedial assistance
- Identifying where teachers need to strengthen content knowledge, teaching skills
- Setting school/district improvement goals
- Tailoring instruction to individual students' needs

Note. Adapted from *The Data-Informed District: A District-Wide Evaluation of Data Use in the Natrona County School District,* p. 75, by J. C. Wayman, V. Cho, & M. T. Johnston, 2007, Austin: The University of Texas.

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